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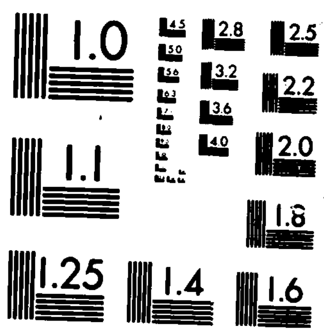

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The material in this TOP is intended to be used for the Human Factors Engineering (HFE) Evaluation of the Soldier-Computer Interface (SCI) of systems tested by TECOM. It encompasses procedures for an HFE Analysis and walk-through, mission simulation, and interview guide. Included are criteria in the form of checklists. (Keywords;

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U.S. ARMY TEST AND EVALUATION COMMAND
TEST OPERATIONS PROCEDURE

AMSTE-RP-702-100
*Test Operations Procedure 1-1-059
AD No.

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1. Scope: The material in this TOP is intended to provide guidance for the planning and conduct of a human factors engineering (HFE) assessment of the soldier-computer interface (SCI) during development testing (DT) by TECOM. The procedures and criteria contained herein will assess the adequacy of those aspects of the software, hardware, and workspace design for the test function of operability that influence operator performance in a computer-based system. Other test functions are not applicable. This TOP should be used in conjunction with TOP 1-2-610, Human Factors Engineering.

2. Facilities and Instrumentation

2.1 Facilities: The facilities for the evaluation of a computerized system will vary depending on the stage of development of the test item. During the early stages of development, the system software is rarely available. Therefore, full-scale evaluation is not possible. During later stages of development, when full-scale testing is possible, the facilities may include equipment or systems that interface with the test item, simulators, and field evaluation. During a human factors evaluation it is important to include the human user since effectiveness of the final products includes the typical user input, both intentional and unintentional. In this regard, SOMTE personnel who represent a range of user experience from novice to expert should be used. Simulation of typical missions should be in "real time" and should include typical environmental, dynamic, and personnel elements, depending upon the stage of design during which the simulation is being performed. Evaluation methods should include quantitative and qualitative measures of system or soldier-computer interface performance. Given the stage of development of the test item, the human factors engineer should determine what facilities are necessary to fully exercise the computer system.

2.2 Instrumentation: At a minimum, the following items from the HFE Instrumentation package will be used for this test (see Table 1 for instrumentation specification):

a. Spot Brightness Meter

b. Photometer

c. Sound Level Meter/Analyzer

d. Anthropometry Kit

e. Timer

f. Event Counter

g. Torque/Force Meter

h. Ruler

i. Camera

j. Videotape Recording Equipment.

TABLE 1: TECOM HFE INSTRUMENTATION PACKAGE

Measurement	Instrument	Range and/or Accuracy
Noise	1. Sound Level Meter/Analyzer	10 to 13 dB $\pm$ 1 dB
Illumination and Brightness	2. Photometer	.002 to 300 ft-lambert $\pm$ 4% R (.007 to 1027 cd/m^2 $\pm$ 4% R) (X100 attenuator to 30,000 ft-lambert $\pm$ 5% R)
	3. Spot Brightness	10^1 to 10^8 ft-lambert $\pm$ 5% R (0.3 to 3.43 x 10^8 cd/m^2 $\pm$ 5% R)
Force and Dimension	4. Torque Meters	0 to 5 in-lb $\pm$ 4% R (above 20% FS) (0 to 0.6 N'm $\pm$ 4% R)
		0 to 160 ft-lb $\pm$ 4% R (above 20% FS) (0 to 217 N'm $\pm$ 4% R)
	5. Force Meter	0 to 250 lb $\pm$ 1.75 lb (0 to 1112 N $\pm$ 7.8 N)
Anthropometry	6. Anthropometry Kit	$\pm$ 0.1 cm
Performance	7. Digital Timer	$\pm$ .001% R
	8. Multiple Event Counter	
	9. Polaroid Camera	
	10. Videotape Recording System	
Recording and Analysis	11. Audio Tape Recorder	
	12. Instrumentation Tape Recorder	
	13. Scientific Calculator	

NOTE: See Table 2-1 in TOP 1-2-610, Human Factors Engineering, for other types of instrumentation.

3. Preparation for Test

3.1 General Guidelines: The primary emphasis for performing a human factors engineering test of a computer-based system is the assessment of how well the soldier-computer interface supports the operator in the performance of those tasks necessary for successful completion of the system mission. The major requirements in the preparation of an HFE test plan for the soldier-computer interface are to identify what is to be tested, how the test is to be conducted, and what criteria are to be used. The determination of what is to be tested and analyzed in an HFE test of the SCI requires the identification of objectives and critical issues for testing, and the selection of test measures. In the process of determining critical issues, previous test records on the item should be studied to ascertain any human factors problems that may have been identified in earlier development testing. HFE test objectives, as well as related critical issues, may be designated in the independent evaluation plan (IEP), test design plan (TDP) or other pertinent information concerning the test item. Such background information shall be used to tailor the HFE subtest of the SCI, as well as the data-collection techniques, to the particular item being tested. For some tests of the SCI, the HF engineer should coordinate with other test elements to ensure the availability of facilities and instrumentation or data appropriate for the SCI subtest. The specific steps to be followed in preparing an HFE test plan for the SCI are described below.

3.2 Step 1 - Review Documentation: For an assessment of the soldier-computer interface to be effective, the human factors engineer must be as knowledgeable as possible about the test item. All available system documentation should be read to determine the nature of the system's mission and how the operator interacts with the system in achieving that mission. The following are typical types of documentation that should be reviewed:

a. System Specifications

b. System Descriptions

c. Operator Manuals

d. Appropriate Task Analysis Data, if available

e. Any previous HFE evaluation of the test item

f. TOP 1-1-056, Software Testing

g. Requirement Documents (LDA, ROC, LR, TDR)

h. Operational and Organizational Concept

i. TOP 1-2-610, Human Factors Engineering.

j. Any other relevant documentation available

The human factors engineer should then use this information to aid in the classification of the SCI and the selection of design checklists and criteria appropriate for inclusion in the test. This documentation is also useful in selecting (1) appropriate scenarios for system performance testing, and (2) appropriate topic areas for inclusion in questionnaires and interviews.

3.3 Step 2 - Classification: The objective of this step is to aid the human factors engineer in the selection of appropriate checklist criteria by providing guidance for classifying the computer-based subsystem of the test item. The classification is based on two factors that influence the design of the soldier-computer interface, the expected deployment of the system and the expected tasks that the operator performs when interacting with the SCI. By defining these two elements, typical types of checklist criteria can be defined. Paragraphs 3.3.1, 3.3.2, and 3.3.3 discuss this.

While this classification process will aid the user in selecting typical checklist criteria, it is based primarily on general classes of systems. It is important to be aware that some test items may not lend themselves to classification due to special design considerations or emerging technology. Therefore, the test item should be carefully examined to ensure that all the applicable criteria are being used during the test.

3.3.1 Define System Deployment: Deployment is defined as the physical manner in which the system will be used in the field. While most systems will be deployed in only one manner, some may have several different modes of deployment. The human factors engineer should review the system documentation and determine the expected system deployment based on the following list:

a. Aircraft: Any computerized system that has the soldier-computer interface located in an aircraft.

b. Ground vehicle: Any computerized system that has the soldier-computer interface located in a ground vehicle, excluding shelters.

c. Portable: Any computerized system that is physically transported by one or more soldiers. This includes systems such as radios, weapons, and other systems that are not physically part of a larger system. This type of system is typically used outside or in a tent where the environment is not very controlled, not in a shelter, building, or vehicle.

d. Shelter: Any computerized system that is placed in a transportable or mobile shelter.

e. Building: Any computerized system that is deployed in a nonmobile structure.

3.3.2 Define Operator Tasks: The tasks that the operator performs when interacting with the SCI act to define how it is designed. These tasks may differ from those that the computerized system performs during a mission in that the operator is providing direction or information to the computer necessary for it to perform its task(s). The computer-based system may require

that the operator perform more than one task, especially for complex systems. The HFE should review the system documentation and select the appropriate tasks from the list below. This list is representative of typical operator tasks, but may not be inclusive of all possible tasks.

a. Recordkeeping/File Maintenance: This task consists of simple data entry into already existing files, editing of files, monitoring of the data in the files, and some limited self-test capability. The data tends to be numerical in nature and static as opposed to dynamic. Examples of this type of task include keying in of frequencies for communications, parameter files for EWI devices, or fire control parameters.

b. Text Editing: This task is analogous to word processing. There is extensive entry of alphanumeric data with extensive manipulation by editing commands. Information can be communicated between distributed networks of terminals.

c. Data Communication: This task consists of the formatting, sending, and reception of data in the form of messages, either alphanumeric or just numeric. The format may be fixed or variable.

d. Target Tracking: This task consists of the detection, recognition, identification, and tracking of targets. Examples of this type of task include tactical data display, air defense, and fire control. The data are dynamic in nature.

e. Data Management: This task consists of manipulation of data through sorting of files, statistical analysis, and mathematical formulas. The data tend to be static in nature.

f. Simulation: This task consists of the extrapolation from existing data to predict possible outcomes based on specific scenarios.

g. Status Monitoring: This task consists of monitoring of dynamic information regarding system status. The computer integrates various data sources into a display for operator decision making, and system or process control.

3.3.3 Determine Classification: Once the deployment and tasks have been determined, the classification of the system should be determined. Some systems may have more than one classification. The classifications should be ascertained from Table 2. The terminology used to designate a specific classification is arbitrary and does not denote any other meaning.

3.4 Step 3 - Identify Criteria:

3.4.1 General Guidelines: The soldier-computer interface can be assessed in terms of various hardware, software, and workspace user considerations. These considerations conform to general human factors characteristics found to be basic to good system design in other applications. These considerations include:

TABLE 2: CLASSIFICATION OF THE SOLDIER-COMPUTER INTERFACE BY DEPLOYMENT AND TASK

Deployment	Task	Classification
Aircraft	Recordkeeping/File Maintenance	1
	Data Communication	2
	Target Tracking	3
	Data Management	4
	Status Monitoring	5
Ground Vehicle	Recordkeeping/File Maintenance	1
	Data Communication	2
	Target Tracking	6
	Data Management	4
	Status Monitoring	7
Portable	Recordkeeping/File Maintenance	8
	Text Editing	19
	Data Communication	9
	Target Tracking	10
	Data Management	11
	Status Monitoring	2
Shelter	Recordkeeping/File Maintenance	12
	Text Editing	13
	Data Communication	14
	Target Tracking	15
	Data Management	16
	Simulation	17
	Status Monitoring	18
Building	Recordkeeping/File Maintenance	12
	Text Editing	13
	Data Communication	14
	Target Tracking	15
	Data Management	16
	Simulation	17
	Status Monitoring	18

a. Compatibility: Workspace, input and output devices, and software should be compatible with user needs. Input required of the user should be compatible with the output of the computer and vice versa. Information presented to the operator should be appropriate for the task.

b. Flexibility: A system should be flexible to the degree that individual differences in skill are encompassed to ensure optimal performance of all users under all anticipated conditions.

c. Workload Reasonability: The tasks required of the operator should be within the operator's capability and should require the operator to perform a useful, meaningful role. Optimum design takes advantage of the best capabilities of both operator and machine and does not induce information or work overload.

d. Brevity: Human memory can accept a limited amount of information. This implies that information presented to the operator or entered by the operator should be grouped into short, readily understandable units.

e. Immediate Feedback: Operators should always be presented with readily understandable information so that they know where they are, what they have done, and whether the operation was successful. They should be given every opportunity to correct errors.

A complete assessment of any soldier-computer interface requires that the human factors engineer or a human factors specialist working under the direct supervision of the human factors engineer observe the operators perform a simulated mission. This provides both quantitative and qualitative data that are derived from actual system operation. The interaction of all the system components (human, hardware, and software) should be assessed in a typical use environment. The specific criteria for system performance are usually defined by the Independent Evaluation Plan (IEP), the Test Design Plan (TDP), and other requirement documents. General criteria include the following:

a. Time: Response time is constrained by system requirements. Within these requirements, the computer system shall respond in a timely manner. The operator shall receive an indication of command acceptance within an acceptable time. The output of required information shall be within an acceptable time. The completion of the system mission shall be within acceptable limits.

b. Errors: Number and effect of errors committed by the user due to the system hardware and software design shall not jeopardize mission success.

c. Acceptability: The system shall be designed to meet user expectations to ensure acceptance.

3.4.1.1 Workspace: The nature of the tasks performed by a user when interacting with an automated data processing (ADP) system levies special requirements on the design of the workspace. The user spends a large proportion of time monitoring system performance or interacting with the system software. The design of the work station should support the user's ability to interact with the system. To this end, the workspace shall be designed to ensure compatibility with the physical demands placed on the user by the required tasks. Design areas that are of concern include seating, input and output device location and design, ambient illumination, document storage, and work surface availability. Detailed criteria are contained in Appendix A and should be selected in accordance with Para. 3.4.2.

3.4.1.2 Input and Output Devices: The design of the input and output devices is also influenced by the nature of the user tasks. The following general criteria are applicable to the input and output device design. Detailed criteria are contained in Appendix A and should be selected in accordance with Para. 3.4.2.

a. Input Devices: Input devices shall be designed to facilitate the manipulation and control of the computer system function and data. Areas of design that are of concern include appropriateness of the input device, accessibility, dimensions, and compatibility with operator needs.

b. Output Devices: System output devices shall be designed to ensure that the information being displayed is detectable, discriminable, recognizable, and readable. Areas of design that are of concern include viewing angle and distance, visual angle of characters, character form, luminance contrast and display lighting, and auditory signal volume and frequency.

3.4.1.3 Software: User considerations involving software should include the following, at a minimum (Detailed criteria are contained in Appendix A and should be selected in accordance with Para. 3.4.2):

a. Data Display: Information displayed should be organized in a way which facilitates operator performance. This includes presentation and structuring of information on the computer display. The major areas of concern should include information coding, information density, labeling, and format.

b. Data Entry Procedures: Procedures for data input should be efficient and reliable.

c. Interactive Control: The extent to which a user feels in control of the interactive process depends significantly on which information is presented when. Dialogues should be designed to be compatible with operator needs and to accommodate individual differences for optimal system performance. Considerations should include choice of dialogue mode, form-filling, computer prompting, menu selection, and command languages. Command language should reflect the user's point of view and training, allowing the user to request help at any time.

Concerns should include organization of commands, command nomenclature, use of default values, user control of multiple commands, macros and priority commands, command operation, system response time, and special commands.

d. Feedback: Operators should always be presented with readily understandable information on the status of system functioning. Considerations deal primarily with information presented to the operator on the display. The major areas of concern should include system status and error messages.

e. Error Management/Data Protection: Operator error is intrinsic to every soldier-computer interface. Software should be designed so that catastrophic situations such as inadvertent deletion of data are avoided and error recovery is accomplished easily and quickly. Areas of concern should include error recovery control, help and documentation, computer aids, hard copy output; command cancellation, verification of ambiguous or destructive actions, sequence control, and system failures.

3.4.2 Design Checklist Criteria Selection: Using Table 3, identify those design checklists that are appropriate for the classification of the SCI test item identified in Para. 3.3. Table 3 provides a matrix that lists each classification and the design considerations applicable to the soldier-computer interface. Each cell of the matrix indicates the number and subsection of the appropriate checklist for that class of SCI, by design consideration. As stated in Para. 3.1, the design checklists identified using this table are appropriate for general classes of the SCI. Some systems may not lend themselves to this table. In addition, the design checklists include some criteria that are not drawn from MIL-STDs or other requirements documents. They are included to provide suggested improvements for preferred design of the SCI. The Checklist Identification Aid form (see Appendix F) may be used to facilitate checklist selection for systems with multiple classifications.

3.5 Step 4 - Identify Use Conditions: The human factors engineer will ensure that the test of the soldier-computer interface is performed under conditions representative of item use to the extent that such conditions are expected to have an effect on performance in operating the system. Applicable use conditions should be selected from the list below. Additional information may be found in Para. 3.3 of TOP 1-2-610.

3.5.1 User (Test Participant) Conditions

a. Gender (male, female)

b. Body size (height, weight, etc.)

c. Limb size (dimensions, reach distance, etc.)

d. Clothing (size, type)

e. Encumbrances (combat pack, weapon, radio)

TABLE 3: SOLDIER-COMPUTER INTERFACE CRITERIA SELECTION BY DESIGN CHECKLIST NUMBER

Design Consideration

Classification	Workspace	Input Device	Output Device	Interactive Control	Data Display	Data Protection/ Error Mgt	Data Entry Procedures	Feedback
1	NA	3, 4, 11, 12	13-15, 18	19 a, b, d-i	20 b, c, e, f	21	22	23
2	NA	3, 4, 11, 12	13-15, 18	19 a, b, d-i	20 a, b, c, e, f	21	22	23
3	NA	3, 4, 6, 11, 12	13, 14, 16-18	19 a, b, d-i	20 a, b, e, f, g	21	22	23
4	NA	3, 4, 11, 12	13-15, 18	19 a, b, d-i	20 b, c, e, f	21	22	23
5	NA	3, 4, 6, 11, 12	13-15, 18	19 a, b, d-i	20 a, b, c, e, f, h	21	22	23
6	NA	3, 4, 6, 10, 11, 12	13-14, 18	19 a, b, d-i	20 a, b, c, e, f, h	21	22	23
7	NA	3, 4, 6, 10, 11, 12	13-15, 18	19 a, b, d-i	20 a, b, c, e, f, h	21	22	23
8	NA	3, 4, 11, 12	15, 18	19 a, b, d-i	20 b, c, e, f	21	22	23
9	NA	2-4, 11, 12	15, 16, 18	19 a, b, d-i	20 a, c, e, f	21	22	23
10	NA	3-5, 11, 12	15, 18	19 a, b, d-i	20 a, b, c, e-g	21	22	23
11	NA	2-4, 11, 12	15, 18	19 a, b, d-i	20 b, c, e, f	21	22	23
12	1	2-4, 6, 8, 11, 12	15-18	19	20 a, b, c, e, f, g	21	22	23
13	1	2-4, 11, 12	13, 15-18	19	20 b-g	21	22	23
14	1	2-5, 7-9, 11, 12	13-18	19	20 a, b, c, e, f, g	21	22	23
15	1	2-6, 8, 10-12	13-15, 17-18	19	20 a-c, e-h	21	22	23
16	1	2-4, 6, 10-12	13-18	19	20 a-c, e-h	21	22	23
17	1	2-6, 8, 10-12	13-15, 16-18	19	20	21	22	23
18	1	2-6, 8, 10-12	13-18	19	20 a-c, e, f, h	21	22	23
19	NA	2-4, 11, 12	13, 15, 18	19a, b, d-i	20 b-f	21	22	23

f. Skills and knowledge (MOS, experience, training)

g. Special considerations (handedness, physical strength, wearing of eyeglasses, and facility of spoken English).

3.5.2 Environmental Conditions

a. Temperature (extremes of heat and cold)

b. Climate (temperature, tropic, desert or cold regions)

c. Ventilation (effects on comfort, safety and performance)

d. Lighting (type, location, levels — effects on visibility)

e. Noise (spectrum, loudness — effects on comfort, safety, reception of communication, performance)

f. Vibration (spectrum and intensity — effects on comfort, safety and performance).

3.5.3 Operational Conditions

a. Threat characteristics (type, number, distance, deployment)

b. Force characteristics (mission profile, operational mode summary, crew composition)

c. Conditions of readiness

d. Blackout conditions

e. Logistical constraints

f. Emergency conditions (e.g., wearing NBC equipment, etc.).

g. Personnel attrition (need for cross-training, ease of training)

h. Duty cycle durations.

3.6 Step 5 - Develop Test Plan: The HFE SCI subtest plan shall be written in accordance with TECOM Reg 70-24. The subtest plan shall follow the following format:

a. Objective: This shall be a concise statement of the objective or issue to be addressed in the subtest, including the subtest's relationship with the overall test objectives.

b. Criteria: This shall be a statement of the criteria contained in or referred to in the IEP, TDP, or TECOM directive. The sources of all criteria should be clearly identified down to the paragraph number.

c. Data Required: This shall be a statement that details the specific data to be obtained during the test. This shall specify the accuracy requirements of the data and the numbers of samples or observations.

d. Data Acquisition Procedure: This shall detail the procedures to be used in collecting the data. The TOP procedure should be referenced along with a brief description of the procedure. If the procedure deviates from a TOP or in the absence of a TOP, the procedure shall be described in detail.

e. Analytical Procedures. This shall describe how the data listed in the data required section will be reduced and analyzed, and how comparison against the criterion statements will be made.

The SCI subtest will be coordinated with the HFE subtest.

4. Test Controls: The test controls appropriate to the test item must be followed. In addition, the test controls from TOP 1-2-610, Human Factors Engineering, should be followed. Test controls specific to the soldier-computer interface are given in the following paragraphs.

4.1 Control of Test Participants: The personnel selected for operators of the test item should be representative of the expected user population once the test item is fielded. Test project personnel, therefore, shall review the item documentation to determine, at a minimum, the following characteristics of the intended user population. In addition, any specific training programs necessary to operate the item must be identified. The information listed below represents sample criteria for subject selection. The distribution of each characteristic in the test participant sample shall be similar to that of the population distribution within selection constraints. The characteristics to be determined and recorded for all participants shall include consideration of the following:

a. Physical Dimensions: Ranges of heights and weights shall be specified, giving due consideration to the range of these dimensions expected of typical user personnel when the system is fielded. Specifically, the range should encompass the 5th through 95th percentile as described in Figure 25.B.7 in TOP 1-2-610, Human Factors Engineering, Part II. Determination must be made of specific body dimensions of importance for item use (reach, seated height, kneeling, etc.) and the 5th through 95th percentile values of these dimensions should be used (Figure 10.D.1 in TOP 1-2-610, Part II). No person with a special-duty or limited duty profile can be permitted to participate unless a task analysis reveals that the restriction on activities has no impact on the tasks required in the test.

b. Sensory Acuity: All test participants should have had a recent (within the last 12 months) test of vision and audition. If vision or audition are critical to the test functions, the appropriate test shall be given both immediately before and after test operations.

Minimum standards should be stated for each of these sensory modalities depending upon an analysis of the requirements of the tasks to be performed. The inclusion of participants who wear glasses should be considered if appropriate to the particular test.

c. MOS: The required MOS will normally be specified in the test directive or TDP. If it is not, a determination must be made of the MOS and whether the specified MOS must be test participant's primary MOS or whether a soldier with this specialty in a MOS is acceptable. If alternate specialties include the required training and are acceptable substitutes, these are to be listed in the TDP. In addition, the training-requirements specification will state whether the MOS must be a school-trained qualification or whether an OJT-qualified soldier meets the requirements.

d. Time in MOS: Each participant should have been assigned to the specified MOS for a sufficient time to be fully qualified.

e. Rank: Test participants should represent the rank and skill levels specified for test item users or as specified in the Requirements Document.

f. Item Specific Training: If training is required for use of the test item, this training shall be provided to test participants prior to data collection. The human factors engineer should ensure that all test participants received standardized training. Exceptions to training should be noted in the test report.

4.2 Control of Procedures: Operators should perform tasks with the test item in accordance with standard Army procedures and those procedures identified in the technical manuals and operating instructions. Additionally, if data are collected by simulation of missions, the scenarios used should be carefully scripted. Tests should be designed and implemented to exercise the soldier-computer interface through all phases of the operating scenaric — both normal and emergency conditions. The scenario should be complete in evaluating all aspects of the soldier-computer interface: visual, auditory, controls, communications, etc.

5. Test Procedures

5.1 Method: A human factors engineering test of the soldier-computer interface is performed using three basic methods: (1) human factors analysis and walk-through; (2) mission simulation; and (3) questionnaire and interview. These methods are interdependent in that the results from one method may dictate changes in the other methods. The appropriateness of the specific methods will depend on the stage of development of the test item and the type of data being collected. During early stages the software is rarely complete; therefore, mission simulation is very difficult if not impossible. The human factors analysis and walk-through can be performed at all stages of development. The questionnaire and interview method require the use of a trained operator. Each method is discussed below.

5.1.1 Human Factors Analysis and Walk-Through: In these methods, the human factors engineer examines the test item using appropriate design checklists selected from Table 3 and any other human factors engineering criteria identified during the document review (Para. 3.2). This evaluation should be aided by a trained operator. This analysis tends to be iterative in nature, typically performed over days or weeks. In addition to immediate data collection, the HFE analysis and walk-through can serve to identify areas for further analysis, identify data requirements for the mission simulation, and further familiarize the human factors engineer with the operation of the system.

The operator directs the human factors engineer through the operation of the test item, explaining each procedural step, how the system is responding, and how the operator must interact with the equipment. The human factors engineer assesses each step of the operation and element of the system for conformance to the criteria contained in the design checklists. Physical measurements are taken as necessary. Times for system response to command input, update rates, and other system response times that can be measured without a full mission simulation will be recorded. The operator will be asked to initiate various system tasks while the human factors engineer observes and records time (see Table 4 for typical response times). The design checklists should be used to ensure that all relevant criteria have been addressed. Detailed information on the use of design checklists is contained in Section 5.10, Test Procedure - HFE Design Checklists of TOP 1-2-610. Details of these methods as they relate to hardware, software, and system performance are described below.

5.1.1.1 Workspace: The human factors engineer will evaluate all aspects of the workspace design that are relevant to the soldier-computer interface. This will include, but not necessarily be limited to, the following:

a. Workstation Configuration: The physical dimensions of the workstation will be measured using the appropriate instrumentation from the HFE Instrumentation Kit. These measurements will include, but not be limited to, the following: viewing angle; viewing distance; keyboard height from floor; keyboard slope; reach distance to the back of the keyboard and other controls; height, width, and depth of writing and work surfaces; height, width, and depth of the operators' leg space and kickspace. Refer to Figure 1 for an illustration of typical measurements.

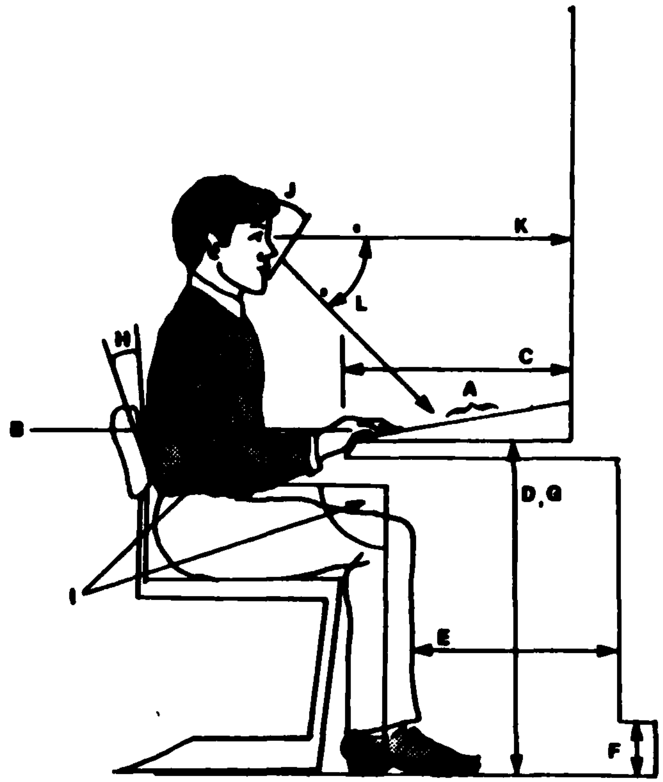
b. Seating: The seating available to the operator will be evaluated for the following, at a minimum: adjustability to accommodate the 5th percentile female and the 95th percentile male population; support for maintaining proper body posture; availability and design of armrest; support provided by backrests; and availability of footrests.

c. Ambient Illumination: Ambient illumination will be measured in accordance with the procedures contained in TOP 1-2-610, Human Factors Engineering, Para. 5.1, Test Procedure Lighting. Measurement should be made at hard copy devices, displays, controls, and writing surfaces, if present.

TABLE 4: SYSTEM RESPONSE TIMES

(MIL-STD-1472C)

System Interpretation	Response Time Definition	Maximum Acceptable Response Time (Secs)
Key Response	Key depression until positive response; for example, "click"	0.1
Key Print	Key depression until appearance of character	0.2
Page Turn	End of request until first few lines are visible	1.0
Page Scan	End of request until text begins to scroll	0.5
XY Entry	From selection of field until visual verification	0.2
Function Selection	From selection of command until response	2.0
Pointing	From input of point to display poin	0.2
Sketching	From input of point to display of line	0.2
Local Update	Change to image using local data base; for example, new menu list from display buffer	0.5
Host Update	Change where data is at host in readily accessible form; for example, a scale change of existing image	2.0
File Update	Image update requires an access to a host file	10.0
Inquiry (Simple)	From command until display of a commonly used message	2.0
Inquiry (Complex)	Response message requires seldom used calculations in graphic form	10.0
Error Feedback	From entry of input until error message appears	2.0



KEYBOARD { A Slope, 15°
B Height, home row, 29 to 30 in.
C Front of desk to back row of keys, 16 in. max.

DESK { D Top height, 29 to 30 in.
E Leg room, 25 in.
F Kick space, 4x4 in.

WRITING SURFACE { G Height 29 to 30 in. (to floor)

SEATING { H Backrest recline, 10° to 15°

BODY POSITION { I Arm and leg angle, (posture) 90°
J Head tilt, 20°

VIEW { K Preferred viewing distance, 16 in.
L Viewing angles, 90° max, 45° preferred

FIGURE 1: TYPICAL WORKSPACE MEASUREMENTS FOR THE SOLDIER-COMPUTER INTERFACE

5.1.1.2 Input and Output Devices: Using design checklists, the human factors engineer will evaluate all aspects of the design of the input and output devices that are relevant to the soldier-computer interface. The following, at a minimum, will be measured:

a. Control dimensions, resistance, and displacement

b. Display size, viewing distance, and viewing angle

c. Display character size and visual angle

d. Control labeling dimensions

e. Luminance contrast of display characters in accordance with para. 5.1, Test Procedure - Lighting from TOP 1-2-610, Human Factors Engineering

f. Frequency range and signal-to-noise ratio of auditory signals in accordance with para. 5.2, Test Procedure - Noise Measurement from TOP 1-2-610, Human Factors Engineering.

5.1.1.3 Software: The human factors engineer will observe the operator interact with the software. The operator will call up all available software formats or a representative sample if many formats are identical, and demonstrate the techniques used to manipulate the system. The human factors engineer will, at a minimum, use design checklists to evaluate the aspects of the software interface presented below. The human factors engineer should identify and discuss with the operator potential HFE problems in system performance or design characteristics of the hardware.

a. Data Display: How data are displayed on a screen is critical to effective communication between a computer system and its users. A display format should be easily read, interpreted and able to be used by people of varying skill. The human factors engineer should pay particular attention to information format, labeling, coding, density and screen layout. Software formats should be standardized within the system.

b. Data Entry Procedures: One of the most critical aspects of the SCI is the technique used for requesting input from the user. Poorly designed data entry procedures can make a system inaccessible to all but highly trained and experienced users. Errors by terminal users are inevitable, however, careful design of input procedures can reduce the frequency and consequences of errors and simplify the correction of errors. A well-designed system permits users to perform their job with a minimum of time and effort spent on data entry. In evaluating this aspect of the software interface, the human factors engineer will review data entry procedures using design checklists and observe the operator interact with the computer system. Times for system response to command input will be measured and recorded.

c. Interactive Control: One of the determinants of user satisfaction and acceptance of a system is the extent to which the user feels in control of the interaction. If users are unable to control the pace and direction of the interaction they will feel frustrated or threatened by the system. The extent to which a user feels in control of the interactive process depends significantly on which information is presented when. The appropriate information presented at the correct time can make an otherwise difficult and time-consuming task easy and fast. Language and coding should be legible, brief, clear, concise and consistent within the system. When ambiguity and confusion are minimized performance is faster and more accurate. Displayed messages should be reviewed keeping the above principles in mind. During this aspect of the software evaluation, the human factors engineer will focus on command methods, organizations and languages; system response times; dialogue modes; prompting; and menus. System response times will be measured and recorded.

d. Feedback: Users need to know that the system is functioning and that their commands are received and being processed by the system. Major areas of concern include status and error messages; help and documentation; and hard copy output. The human factors engineer should have the operator interact with the system such that the various forms of feedback provided by the system are demonstrated. During this aspect of the software evaluation the human factors engineer will focus on command methods, organizations and languages; systems response times; dialogue modes; prompting; and menus. System response times will be measured and recorded.

e. Data Protection/Error Management: Errors made by system users are inevitable. However, careful design of procedures for correcting errors, cancelling commands, and protecting data from destructive actions can reduce the frequency and consequences of errors and simplify correction of errors. The human factors engineer should review the sequence of events in command cancellation, verification of destructive actions, and system failures. HFE problem areas should be identified for further evaluation during mission simulation and/or or operator interviews.

5.1.2 Mission Simulation: The objective of a mission simulation is to assess the operational characteristics of the soldier-computer interface under realistic use conditions. The human factors engineer observes simulated missions that are based on scenarios that exercise to the fullest extent possible the capabilities of the system under test. The scenarios should be representative of the range of mission profiles and tasks, especially the worst case.

Given that a mission simulation can be expensive in terms of man-hours and other resources, it is imperative that the detailed planning be performed well in advance. Part of this planning should include the determination of the feasibility of performing a mission simulation given the expected data return. The following steps should be performed in the planning of a mission simulation.

5.1.2.1 Define Data Requirements: Based on the documentation review and a thorough understanding of all system mission profiles, the types of data to be collected during the mission simulation should be defined. These data should consist of performance measures such as time for task performance, error rates, assessments of workload, assessments of crew interaction, and any other measures that may indicate the efficiency of the soldier-computer interaction. These data requirements should include estimations of the number of trials required for reliability and validity, and estimations of methods for collecting the data. In defining data requirements, it will be necessary to specify what constitutes an error, and whether errors can be prioritized in terms of system consequence.

5.1.2.2 Define Data Collection Methods: Based on the data requirements developed in Para. 5.1.2.1, methods for collecting the data should be defined. These methods should include the instrumentation, facilities, dependent and independent measures, and subject demography (i.e., number, skill level, etc.) required. Since each system is significantly different, there is not a well defined group of methods that are appropriate for all types of systems. The methods will be dependent on the type of range facilities, support facilities, number of test items, and stage of development of the system software. The human factors engineer should determine the best method for collecting the required data, determine the type of support available at the test facility, and modify the data collection methods, as appropriate. The methods should be as nonobtrusive as possible. Potential types of data collection techniques include the following:

a. Performance Times: Performance times can be measured in several ways. These include direct observation by the human factors engineer, the use of videotaping or movies, hardwired event timers, and the use of a computerized data collection tool. The computerized data collection tool is preferable but not always feasible.

b. Error Rates: Error rates can be collected through the same types of methods as performance times. Like performance times, the most accurate method is computerized data collection, but this is not always feasible.

c. Workload: Workload is a very difficult concept to operationally define for purposes of measuring in a quantifiable manner. There are two basic, interactive types of workload, physical and mental. The basic issues in which the human factors engineer should be interested include allocation of tasks between the user and the computer, and the allocation of tasks between the crew members. Some approaches that can be used to measure workload include: time-line analyses; the use of secondary tasks to load the user's information processing capacity; physiological response measures such as heart-rate; and subjective ratings of workload by users. Prior to embarking on an attempt to measure workload, the human factors engineer should review the literature on workload assessment.

d. Crew Interaction: Crew interaction, while a facet of workload, can be measured independently. The critical issues include communications between the crew members and potential physical interference between operators during task performance. Methods for measuring crew interaction include direct observation, video taping or filming, voice recording and subjective assessments by the operators.

5.1.2.3 Define Degree of Simulation: The degree to which the mission of the system under test should be simulated is dependent on several factors. These factors include the following:

a. Stage of System Development: During different stages of development, the completeness of system software and, in some cases, the hardware will vary. The human factors engineer must determine to what degree the system is complete and how the data requirements are affected. The mission simulation plan should be adjusted accordingly. In some cases, the requirement for a mission simulation may be waived due to the lack of sufficient system software or reliability for accurate and valid measurement.

b. Availability of Necessary Support: The availability of the necessary facilities, instrumentation, personnel, and other support requirements identified in Para. 5.1.2.2 will help determine the degree of simulation that can be performed to respond to the data requirements identified in Para. 5.1.2.1. The human factors engineer should assess the availability of the necessary support and modify the data collection methodology accordingly.

c. Estimated Cost: Costs of mission simulations vary depending on the level of support necessary for performance. Range facilities, complex instrumentation, large amounts of ancillary equipment, and large numbers of people are a significant contributor to the cost of the conduct of a mission simulation. The more complex the simulation, the greater the necessary support and the higher the cost. The human factors engineer should estimate the cost of the mission simulation based on the data collection techniques identified in Para. 5.1.2.2.

The above three factors should be reviewed in regard to the item under test and any necessary trade-offs made to maximize the quality of the data. In some cases, the use of a mission simulation may not be appropriate or may be prohibitively expensive, and therefore waived. In other cases, the degree of simulation may vary from extremely simple to very complex.

5.1.2.4 Develop Mission Scenarios: The human factors engineer, working in concert with others, should develop mission scenarios. The scenarios should be developed from a review of the various information sources cited in paragraph 3.2 and discussions with subject matter experts (SMEs). A task analysis should be used to identify critical missions and task sequences, points of peak operator workload, and expected performance times. The scenarios should

contain missions and task sequences that represent worst case operational conditions that are as realistic as possible. A detailed script should be developed and verified as correct well before the initiation of the mission simulation. The human factors engineer should become thoroughly familiar with each script to ensure that there is no loss of data during the observation of the mission simulation. The complexity of the scenario will depend on how complete the test item's software is and the availability of support personnel and equipment.

5.1.2.5 Develop Detailed Data Collection Plan: A detailed plan for how the mission simulation data are to be collected should be developed. This plan should define all support requirements, including equipment, instrumentation, facilities, personnel, and methodology. The methodology should contain the detailed scenarios. The human factors engineer should schedule briefings for all personnel involved to discuss the simulation and ensure that everyone knows their roles and responsibilities, and the schedule. These coordination meetings should be held as frequently as necessary to ensure that the simulation provides the necessary data.

5.1.3 Questionnaire/Interview Guide: In these methods, operator's subjective assessments concerning the soldier-computer interface will be elicited. The questionnaire or interview guide should be developed using information contained in the design checklists (Appendix A). A sample questionnaire/interview guide is provided in Appendix C. The use of questionnaires and interviews to elicit data on system performance should be geared toward user acceptance of the system. Items of discussion should revolve around whether the test item meets the user's expectations and needs. More detailed information is contained in Test Procedure 5.20 - Questionnaires and Interviews from TOP 1-2-610. The human factors engineer should also refer to TECOM PAM 602-1 for details on the development and construction of questionnaires and interviews.

a. Workspace: This is usually thoroughly evaluated using quantitative measurement methods. Questionnaires and interviews can also be used to elicit data that are not readily apparent by direct observation. These methods can also be used to gain subjective evaluation of discrepancies from criteria.

b. Input and Output Devices: The assessment of controls and displays is primarily accomplished by quantitative measurement methods. But like workspace, questionnaires and interviews can also be used to elicit data and gain subjective evaluation of discrepancies from criteria.

c. Software: Questionnaires or interviews used for software should focus on those criteria which are difficult to evaluate quantitatively and which involve more subjective evaluation of the system item by the user. For example, the questionnaire/interview should elicit information from the operator such as the ease or difficulty of operating the system. Routine problems the operator encounters involving inputting or accessing data, display organization, difficulty in remembering commands, difficult sequences of operation, and identifying and correcting errors should also be addressed.

5.1.4 Test Conduct: To conduct a test requires careful planning by the human factors engineer in terms of (1) the arrangements to be made prior to conducting the test; (2) any practice conducting the test prior to the main test; and (3) the procedures to be used during the test. Once the test has begun every effort should be made to continue it to completion without interruptions.

a. Arrangements to be made prior to conducting the test: The human factors engineer will first determine who (i.e., the human factors engineers or other test agency personnel) will conduct different parts of the evaluation. The test engineer will select relevant checklists to be used during evaluation, acquire the instrumentation needed to conduct the test, and schedule the time of operator(s) and work station(s) of interest. If a particular evaluation involves special considerations, such as clothing, the human factors engineering will make these arrangements.

b. Practice prior to the test: Every effort should be made to ensure smooth conduct of the tests described above. The human factors engineer will ensure that personnel conducting test, using checklist or administering questionnaires or interview are thoroughly familiar with procedures to be followed and equipment used during evaluation. Practice prior to the test may expedite conduct of the test and enhance the quality of results.

c. Procedures used during the test: Tests will be performed as described in section 5.1.

5.2 Data Required: The data required should include the following:

a. A comprehensive list of all physical measurements taken. This should include equipment used to take measurements, their serial numbers, and calibration dates.

b. The results of checklist administration. This should also include copies of the checklist used. Photos of all discrepancies should be obtained for use in data analysis and test reporting.

c. The results of questionnaires and interviews. This should include copies of responses to questionnaire, and interview forms.

d. The results of mission simulation (if appropriate). This should include videotape of the simulation, results from any checklists or recording forms used, any system times or error rates recorded during simulation.

6. Data Reduction and Presentation: The degree to which the test item conforms or does not conform to human factors engineering specifications, standards, and requirements should be presented in narrative form. Instances of nonconformance should be supported by relevant measurements and photographic illustrations. The causes and consequences of nonconformance shall be

analyzed with regard to effect on systems and mission performance. All quantitative measurement data (e.g., anthropometric, illumination, etc.) shall be presented in tabular or graphic form for direct comparison with the specified criteria and to show the degree of compliance or noncompliance. The results of checklists and questionnaires/interviews shall be summarized and presented in tabular form. When adequate samples are available, the results should be submitted to statistical analyses. Any degradation of the effectiveness of the man-item relationship with regard to operation of the system shall be assessed and corrective action recommended.

Each discrepancy from the criteria should be analyzed for its impact on mission performance. This analysis will include, at a minimum, the following:

a. Potential Type of Error: The type of error that the discrepancy could induce should be determined. In some tests the mission simulation will provide this information. Types of general errors are defined in Para. 5.14.4 of TOP 1-2-610, Human Factors Engineering.

b. Probability of Error: Estimations should be made of the probability of errors occurring. These estimations should be based on the frequency and difficulty of tasks involving the discrepancy, and the potential for a stressful environment during task performance involving the discrepancy. Reference should be made to Para. 5.14-Test Procedure-Error Likelihood Analysis in TOP 1-2-610, Human Factors Engineering.

c. Recovery from Error: Estimations should be made of the probability of the operator(s) recognizing that a error has occurred and correcting it. The effect of the error correction on mission performance should also be determined.

d. Error Propagation: Estimation should be made of the potential for one error leading to one or more other errors.

e. Synergistic Effects: The human factors engineer should consider the cumulative effects of discrepancies. While individual design problems may not seem important, groups of discrepancies can interact to create a composite potential for error.

f. Consequences of Error: The consequences on mission performance of the error(s) induced by the discrepancy should be determined from mission simulation data, documentation, and/or SMEs.

The human factors engineer should integrate the results of the above analyses and develop a list of well defined design problem areas.

Judgments will be made as to whether these problems represent deficiencies or shortcomings. In determining whether a problem is a deficiency or shortcoming, the following checklist (from TOP 1-1-012) should be used:

a. Does the incident (performance or component):
   (1) Create a hazard to personnel or equipment?
   (2) Seriously impair operational capability?
   (3) Cause serious damage if operations were to continue?

b. If answer is "yes" to one or more of the above, is the incident:
   (1) Something not anticipated in equipment of this type?
   (2) A characteristic of design that requires change?
   (3) Expected to occur again at similar frequency (i.e., not random)?

c. If answer is "yes" to all three (paragraph 5.12.6b), the problem is a true deficiency. If the answer to any one of the three is "no," it is a shortcoming.

Test Incident Reports (TIRs) should be completed for all discrepancies and forwarded to the responsible agency.

Recommended changes to this publication should be forwarded to Commander, U.S. Army Test and Evaluation Command, ATTN: AMSTE-TC-M, Aberdeen Proving Ground, MD 21005-5055. Technical information may be obtained from the preparing activity: Commander, U.S. Army Test and Evaluation Command, ATTN: AMSTE-EV-H, Aberdeen Proving Ground, MD 21005-5055. Additional copies are available from the Defense Technical Information Center, Cameron Station, Alexandria, VA 22304-6145. This document is identified by the accession number (AD No.) printed on the first page.

APPENDIX A
SAMPLE DESIGN CHECKLISTS

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Appendix A

Sample Design Checklists

This appendix contains a series of sample design checklists for evaluating the soldier-computer interface. These checklists could be used as guidance in developing checklists tailored to the test time. Paragraph numbers in parentheses at the end of a checklist item refer to the MIL-STD-1472C paragraph number. Other checklist items are not requirements, but principles of good human factors design.

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DESIGN CHECKLIST

Workspace

(1)

Test Title ______________________________

Test Project No. ________________ **Date** ________________

Detailed Design Considerations	YES	NO	N/A	Comments
1. Illuminance of working areas for printers and other hard-copy devices is between 540 and 1075 Lux (50 to 100 ft-c). (5.8.2)				
2. The height of the home key row of keyboards is between 720 and 750mm (29 to 30 in.) from the floor.				
3. Desk top height is 720mm (29 in.).				
4. There is leg room under desks that meets or exceeds the following (5.7.3.5): Height 640mm (25 in.) Width 510mm (20 in.) Depth 460mm (18 in.)				
5. If a fixed footrest or foot control is used, the knee room height is increased accordingly. (5.7.3.5)				
6. A kick space of at least 100mm (4 in.) in depth and 100mm (4 in.) in height is provided under the desk. (5.7.1.1)				

YES = Adequate **NO = Inadequate** **N/A = Not Applicable**

Workspace

Detailed Design Considerations	YES	NO	N/A	Comments
7. The keyboard is in easy arm's reach with the back row of keys no more than 400mm (16 in.) from the front of the desk/work surface.				
8. Work seating provides adequate support for the body relative to the task. (5.7.3.4.1)				
9. Work seating is operationally compatible with the console configuration. (5.7.3.4.1)				
10. Seating is vertically adjustable from 380 to 535mm (15 to 21 in.) in increments of no more than 25mm (1 in.) each. (5.7.3.4.2)				
11. Backrests and seats are cushioned with at least 25mm (1 in.) of compressible material. The surface is smooth. (5.7.3.4.4)				
12. Backrests recline between 1745 and 2005 Mrad (100 and 115 degrees). (5.7.3.4.3)				
13. Backrests engage the lumbar and thoracic regions of the back. (5.7.3.4.3)				
14. The backrest supports the torso so that the operator's eyes can be brought to the "eye line" with no more than 75mm (3 in.) of forward body movement. (5.7.3.4.3)				

Workspace

Detailed Design Considerations	YES	NO	N/A	Comments
15. Armrests are provided. (5.7.3.4.5)				
16. Armrests that are integral to the chair are at least 50mm (2 in.) wide and 200mm (8 in.) long. (5.7.3.4.5)				
17. Modified or retractable armrests are adjustable from 190 to 280mm (7.5 to 11 in.) above the compressed sitting surface. (5.7.3.4.5)				
18. If possible, the work station is designed so that the operator's sitting posture allows a 90° angle between the forearm and upper arm and a 90° angle between the shin and the thigh.				
19. The work station is designed so that the user's head is tilted forward 20° from the vertical plane.				
20. There is a minimum of sideways and downward twisting of the head.				
21. The user's feet rest flat on the floor.				
22. Footrests are adjustable from 0 to 50mm (2 in.) in height and between 10° and 15° in inclination.				

Workspace

Detailed Design Considerations	YES	NO	N/A	Comments
23. Adequate and suitable storage space is provided on consoles and immediate workspaces for manuals, worksheets, and other material required by operator. (5.7.1.3.4)				
24. Writing surfaces, if used, are between 740 and 890mm (29 and 31 in.) above the floor. (5.7.3.2)				
25. Writing surfaces are at least 610mm (24 in.) wide and 400mm (16 in.) deep. (5.7.3.3)				
26. Work surfaces, if used, are at least 760mm (30 in.) wide and 400mm (16 in.) deep. (5.7.3.1)				
27. Document holders, if used, are located between 450 and 500mm (18-20 in.) from the user's eyes at a 20° angle from the vertical plane.				
28. Document holders are located as close to the display screen and keyboard as possible.				

DESIGN CHECKLIST

Keyboards - Alphanumeric

(2)

Test Title ______________________________

Test Project No. ____________________ **Date** ____________________

Detailed Design Considerations	YES	NO	N/A	Comments
1. Numeric keyboards, used only for numeric information entry, are arranged in a 3 x 3 x 1 matrix with the zero digit centered on the bottom row. (5.4.3.1.3.2a)				
2. Alphanumeric keyboards are of QWERTY design and conform to MIL-STD-1280. (5.15.2.2.2)				
3. Alphanumeric keyboards, where there is equal entry of alpha and numeric characters, have a visual separation of the numeric keys. (5.4.3.1.3.2b)				
4. Keys conform to the following dimensions (5.4.3.1.3.3): Diameter Min. 10mm (0.385 in.) Max. 19mm (0.75 in.) Preferred 13mm (0.5 in.) Resistance Numeric Min. 1 N (3.5 oz.) Max. 4 N (14.0 oz.)				

YES = Adequate **NO = Inadequate** **N/A = Not Applicable**

Keyboards - Alphanumeric

Detailed Design Considerations	YES	NO	N/A	Comments
Alphanumeric & Dual Function Min. 250 MN (0.9 oz.) Max. 1.5 N (5.3 oz.)				
Displacement Numeric Min. 0.8mm (0.13 in.) Max. 4.8mm (0.19 in.)				
Alphanumeric Min. 1.3mm (0.05 in.) Max. 6.3mm (0.25 in.)				
Dual Function Min. 0.8mm (0.03 in.) Max. 4.8mm (0.19 in.)				
Separation Between Adjacent Key Tops Min. 6.4mm (0.25 in.)				
5. The slope of nonportable keyboards is between 260-435 Mrad (15-25°) from the horizontal. (5.4.3.1.3.4)				
6. Multiple keyboards have the same configuration throughout the system. (5.4.3.1.3.5)				
7. Feedback is provided to inform the user that the intended key was pressed. (5.4.3.1.3.6)				
8. Feedback is provided to inform the user that the next operation may be initiated. (5.4.3.1.3.6)				

Keyboards - Alphanumeric

Detailed Design Considerations	YES	NO	N/A	Comments
9. Keyed data, except security items, are echoed on the display within 0.1 sec. (5.15.2.2.3)				
10. The key used to enter is explicitly labeled "ENTER."				
11. Mechanical overlays covering the keyboard are not used. (5.15.9.1)				
12. Systems requiring substantial numeric input have a numeric keypad. (5.15.2.2.6)				
13. Function keys on alphanumeric keyboards conform to the salient criteria on checklist 3 -Function Keys.				

Keyboards - Alphanumeric

Detailed Design Considerations	YES	NO	N/A	Comments

DESIGN CHECKLIST

Keyboards - Function Keys

(3)

Test Title ______________________________

Test Project No. ____________________ **Date** ____________________

Detailed Design Considerations	YES	NO	N/A	Comments
a. General				
1. Function keys are used for time-critical, error-critical, or frequently used control inputs. (5.15.2.3.1)				
2. Function keys, if legend pushbuttons, conform to the following dimensions (5.4.3.1.5.1): Size Min. 19mm (0.75 in.) Max. 38mm (1.5 in.) Displacement Min. 3mm (0.125 in.) Max. 6mm (0.25 in.) Barrier width (separation) Min. 3mm (0.125 in.) Max. 6mm (0.25 in.) Barrier height Min. 5mm (0.188 in.) Max. 6mm (0.25 in.) Resistance Min. 2.8N (10 oz.) Max. 16.7N (60 oz.)				
3. Keys are logically grouped in distinctive locations on the control panel. (5.15.2.3.6)				

YES = Adequate **NO = Inadequate** **N/A = Not Applicable**

Keyboards - Function Keys

Detailed Design Considerations	YES	NO	N/A	Comments
4. The most important and frequently used keys are located in the most convenient and visible part of the panel.				
5. Critical keys or keys subject to inadvertent activation are guarded.				
6. Barriers are used for critical switches that are likely to be inadvertently activated. (5.4.3.1.5.2)				
7. Barriers, if used, do not obscure visual access to controls, labels or displays. (5.4.3.1.5.2)				
8. There is a positive indication of key activation in the form of a detent or click. (5.4.3.1.5.3a)				
9. Backlit keys have lamp test capability, dual lamp/filament reliability, or a mean time between failure (MTBF) of 100,000 hours. (5.4.3.1.5.3c)				
10. Backlit key lamps are replaceable by hand from the front of the panel or keyboard. (5.4.3.1.5.3d)				
11. Key covers are keyed to prevent the chance of interchange. (5.4.3.1.5.3d)				

Keyboards - Function Keys

Detailed Design Considerations	YES	NO	N/A	Comments
12. Keys require only single activation to accomplish their function. (5.15.2.3.7)				
b. Fixed Function				
13. Fixed function keyboards are used when the command set is small and the users are naive.				
14. Lockout of fixed function keys is minimized. (5.15.2.3.4)				
15. Nonactive fixed function keys are replaced by a blank key on the keyboard. (5.15.2.3.5)				
16. Fixed function keys are standardized throughout the system. (5.15.2.3.3)				
17. System provides acknowledgement of user input if fixed function key activation results in no immediate response. (5.15.2.3.8)				
18. Touch-sensitive keys are provided with feedback such as an integral light. (5.4.3.1.5.3a)				
19. Keys with a continuously available function have a single label on the key.				
20. The label on the key is visible at all times. (5.4.3.1.5.3b)				

Keyboards - Function Keys

Detailed Design Considerations	YES	NO	N/A	Comments
21. Labels have a maximum of three lines. (5.4.3.1.5.3e)				
c. Multifunction				
22. Multifunction keys are used when design considerations make it necessary.				
23. Multifunction key labels are located on the control or adjacent to the control.				
24. The key-label relationship is unambiguous.				
25. The labels are self-illuminated to indicate what function is operational.				
26. Different functions in different operational modes for a function key are as consistent as possible.				
27. Functions occurring in different modes are assigned the same key in each mode, unless sequential or functional grouping dictates otherwise.				
28. Once assigned a function, a function key is not reassigned a different function for a given user. (5.15.2.3.3)				
29. Function key assignments are displayed at all times. (5.15.2.3.9)				

Keyboards - Function Keys

Detailed Design Considerations	YES	NO	N/A	Comments
30. Provisions are made for easily relabeling variable function keys. (5.15.2.4.4)				
31. If direct marking of keys is not possible, the assigned key functions are displayed on the VDU screen. (5.15.2.4.4)				
32. Key caps are used if the uses of the keys vary across users.				
33. Function keys not currently needed are temporarily disabled by the computer.				
34. Functions of keys that are specific to a particular step in a sequence are displayed on the user's display.				
35. The mode-select key is a dedicated control.				
36. The mode selected is prominantly displayed adjacent to the mode-select key.				
37. A list of available modes of operation is provided.				
38. The list of available modes is located and organized so that the operator can readily determine what action is required to obtain a mode.				
39. Keys that are not always active are backlit when enabled.				

Keyboards - Function Keys

Detailed Design Considerations	YES	NO	N/A	Comments
40. Variable function keys are not shifted characters. (5.15.2.4.5)				
41. If the effect of a function key varies, its status is displayed. (5.15.2.4.2)				
42. If a variable function key with a labeled default value is deactivated or reprogrammed, a visual warning is provided. (5.15.2.4.3)				

DESIGN CHECKLIST

Keypads - Alphanumeric

(4)

Test Title ______________________________

Test Project No. ______________ **Date** ______________

Detailed Design Considerations	YES	NO	N/A	Comments
1. Keys conform to the following dimensions (5.4.3.1.3.3):				
2. Diameter Min. 10mm (0.385 in.) Max. 19mm (0.75 in.) Preferred 13mm (0.5 in.)				
3. Resistance Min. 250 MN (0.9 oz.) Max. 1.5 N (5.3 oz.)				
4. Displacement Min. 1.3mm (0.05 in.) Max. 6.3mm (0.25 in.)				
5. Separation Between Adjacent Key Tops Min. 6.4mm (0.25 in.)				
6. Multiple keyboards have the same configuration throughout the system. (5.4.3.1.3.5)				
7. Feedback is provided to inform the user that the intended key was pressed. (5.4.3.1.3.6)				

YES = Adequate NO = Inadequate N/A = Not Applicable

Keypads - Alphanumeric

Detailed Design Considerations	YES	NO	N/A	Comments
8. Feedback is provided to inform the user that the next operation may be initiated. (5.4.3.1.3.6)				
9. Keyed data, except security items, are echoed on the display within 0.1 sec. (5.15.2.2.3)				
10. The key used to enter is explicitly labeled "ENTER."				
11. Mechanical overlays covering the keyboard are not used. (5.15.9.1)				
12. Systems requiring substantial numeric input have a numeric keypad. (5.15.2.2.6)				
13. Keys are logically grouped in distinctive locations on the control panel. (5.15.2.3.6)				
14. The most important and frequently used keys are located in the most convenient and visible part of the panel.				
15. Barriers are used for critical switches that are likely to be inadvertently activated. (5.4.3.1.5.2)				
16. Barriers, if used, do not obscure visual access to controls, labels or displays. (5.4.3.1.5.2)				

Keypads - Alphanumeric

Detailed Design Considerations	YES	NO	N/A	Comments
17. There is a positive indication of key activation in the form of a detent or click. (5.4.3.1.5.3a)				
18. Backlit keys have lamp test capability, dual lamp/filament reliability, or a mean time between failure (MTBF) of 100,000 hours. (5.4.3.1.5.3c)				
19. Backlit key lamps are replaceable by hand from the front of the panel or keyboard. (5.4.3.1.5.3d)				
20. Key covers are keyed to prevent the chance of interchange. (5.4.3.1.5.3d)				
21. Keys require only single activation to accomplish their function. (5.15.2.3.7)				
22. Multifunction key labels are located on the control or adjacent to the control.				
23. The key-label relationship is unambiguous.				
24. The mode-select key is a dedicated control.				
25. The mode selected is prominantly displayed adjacent to the mode-select key.				
26. If direct marking of keys is not possible, the assigned key functions are displayed on the VDU screen.				

Keypads - Alphanumeric

Detailed Design Considerations	YES	NO	N/A	Comments
27. Variable function keys are not shifted characters. (5.15.2.4.5)				

DESIGN CHECKLIST

Lightpens

(5)

Test Title ______________________

Test Project No. ______________ **Date** ______________

Detailed Design Considerations	YES	NO	N/A	Comments
1. Lightpens are used for non-critical, relatively imprecise input functions. (5.15.2.5.1)				
2. The selectable area for an item is as large as possible, at least the size of the displayed label plus one-half a character's distance around the labels.				
3. Lightpens have a discrete activating mechanism such a: a push-tip switch that requires 0.5 N - 1.4 N (2-5 oz.) of force to activate. (5.15.2.5.3)				
4. Lightpens are between 120-180mm (4.7 - 7.1 in.) long and have a diameter between 7-20mm (0.3 - 0.8 in.). (5.4.3.2.7.3)				
5. A convenient clip is provided at the lower right side of the CRT to hold the lightpen when not in use. (5.4.3.2.7.3)				

YES = Adequate **NO = Inadequate** **N/A = Not Applicable**

Lightpens

Detailed Design Considerations	YES	NO	N/A	Comments
6. Feedback is provided for lightpen placement (e.g., an illuminated circle on the display screen), pen actuation, and system reception of the input. (5.15.2.5.4)				
7. Lightpen placement causes a follower to appear at a corresponding point on the display. (5.4.3.2.5.2)				
8. Lightpen movement results in a smooth, equal movement of the follower. (5.4.3.2.5.2)				
9. Refresh rate for the follower is sufficiently high to enhance the appearance of a continuous track for free-drawn graphics. (5.4.3.2.5.2)				

DESIGN CHECKLIST

Joysticks

(6)

Test Title ______________________________

Test Project No. ________________ **Date** ________________

Detailed Design Considerations	YES	NO	N/A	Comments
a. General				
1. Joysticks are used for tasks that require precise or continuous control in two or more related dimensions. (5.15.2.6.1)				
2. Joystick dimensions conform to the following (5.4.3.2.2.3): Length Min. 75mm (3 in.) Max. 150mm (6 in.) Diameter Min. 6.5mm (0.25 in.) Max. 16mm (0.625 in.) Resistance Min. 3.3 N (12 oz.) Max. 8.9 N (32 oz.) Displacement Max. 45° Clearance Display Clearance to Stick Clearance Min. 0 Max. 400mm (15.75 in.) Around Stick Max. - Maximum stick excursion plus 100mm (4 in.)				

YES = Adequate **NO = Inadequate** **N/A = Not Applicable**

Joysticks

Detailed Design Considerations	YES	NO	N/A	Comments
Stick to Shelf Front Min. 120mm (4.75 in.) Max. 250mm (9.875 in.)				
3. A discrete mechanism is provided for actuation/deactuation of the joystick. (5.15.2.6.2)				
b. Isotonic				
4. Isotonic joysticks (displacement joysticks) are used for data pickoff from a CRT, generation of free-drawn graphics, and other tasks where accuracy is more critical than positioning speed. (5.4.3.2.2.1)				
5. If the follower can transit beyond the display edge, indicators aid the operator in bringing the follower back onto the display. (5.4.3.2.2.2)				
6. Isotonic joysticks used for rate control are spring-loaded for return to center. (5.4.3.2.2.1)				
7. Isotonic joysticks are not used in connection with automatic sequencing of a CRT follower. (5.4.3.2.2.1)				

Joysticks

Detailed Design Considerations	YES	NO	N/A	Comments
8. If used in above application, isotonic joysticks are instrumented for null return or are zero-set to the instantaneous position of the stick at the time of sequencing. (5.4.3.2.2.1)				
9. Isotonic joystick movement is smooth in all directions. (5.4.3.2.2.2)				
10. There is no noticeable backlash, cross-coupling or need for multiple corrective movements in rapid positioning of a follower on a display. (5.4.3.2.2.2)				
11. Control ratios, friction and inertia meet the dual requirements of rapid gross positioning and precise fine positioning. (5.4.3.2.2.2)				
12. Delay between control movement and display response is not greater than 0.1 second. (5.4.3.2.2.2)				
c. <u>Isometric</u>				
13. Isometric joysticks (output is a function of applied force, not movement) are not used if the operator must maintain a constant force on the stick. (5.4.3.2.3.1)				

Joysticks

Detailed Design Considerations	YES	NO	N/A	Comments
14. The isometric joystick deflects minimally in response to applied force but perceptibly against a stop at full applied force. (5.4.3.2.3.2)				
15. The X and Y output is proportional to the magnitude of the applied force as perceived by the operator. (5.4.3.2.3.2)				
16. Isometric joysticks without integral switching are finger-grasped. (5.4.3.2.3.3.1)				
17. Isometric joysticks with integral switching are hand-grasped. The dimensions should conform to the following (5.4.3.2.3.3.2): Length 110-180mm (4.3-7.1 in.) Grip diameter Max. 50mm (2 in.) Side clearance 100mm (4 in.) Rear clearance 50mm (2 in.) Force required for full output Max. 118 N (26.7 lbs.)				

DESIGN CHECKLIST

Printed Circuit Switches

(7)

Test Title ______________________________

Test Project No. ______________ **Date** ______________

Detailed Design Considerations	YES	NO	N/A	Comments
1. Printed circuit switches are used for manual programming of PC boards. (5.4.3.1.9.1)				
2. Switches are sufficiently tall to permit error-free operation when using a commonly available stylus (e.g., pencil or pen). (5.4.3.1.9.2a)				
3. Special tools are not required for operation. (5.4.3.1.9.2a)				
4. Resistance is sufficiently high so that the switch will not be inadvertently activated under the expected use conditions. (5.4.3.1.9.2b)				
5. Resistance gradually increases, then drops when the switch snaps into position. (5.4.3.1.9.2b)				
6. The switch cannot be placed between positions. (5.4.3.1.9.2b)				

YES = Adequate **NO = Inadequate** **N/A = Not Applicable**

Printed Circuit Switches

Detailed Design Considerations	YES	NO	N/A	Comments
7. Slide-type switches have sufficient travel to allow for easy recognition of switch position. (5.4.3.1.9.2c)				
8. Slide-type switch travel is at least twice the length (height) of the switch. (5.4.3.1.9.2c)				
9. Rocker-type switch wings, when activated, are flush with the module surface. (5.4.3.1.9.2c)				
10. Switches are sufficiently separated to preclude inadvertent activation. (5.4.3.1.9.2d)				
11. The switch surface is sufficiently indented to accept the point of the stylus without slippage. (5.4.3.1.9.3)				

DESIGN CHECKLIST

Mouse (Free-moving XY controller)

(8)

Test Title ______________________

Test Project No. ______________ Date ______________

Detailed Design Considerations	YES	NO	N/A	Comments
1. A mouse is used for data pickoff or entry of coordinate values. (5.4.3.2.6.1)				
2. A mouse is not used for the generation of free-drawn graphics. (5.4.3.2.6.1)				
3. The generation of X and Y outputs by the mouse controller results in proportional displacement of a follower. (5.4.3.2.6.1)				
4. The user can orient the controller to within $\pm$ 175 Mrad (10^{o}) of the correct orientation without visual reference to the controller. (5.4.3.2.6.2)				
5. The controller is easily movable in any direction without a change of hand grasp. (5.4.3.2.6.2)				
6. Movement of the controller results in smooth movement of the follower in the same direction $\pm$ 175 Mrad (10^{o}). (5.4.3.2.6.2)				

YES = Adequate NO = Inadequate N/A = Not Applicable

Mouse

Detailed Design Considerations	YES	NO	N/A	Comments
7. The controller is cordless and operable with either the right or left hand. (5.4.3.2.6.2)				
8. Complete movement of the controller from one side of the maneuvering area results in equal movement of the follower, regardless of scale setting or offset. (5.4.3.2.6.2)				
9. If the controller is capable of driving the follower off the display edge, indicators are provided to assist in bringing the follower back onto the display. (5.4.3.2.6.2)				
10. The controller has no sharp edges and is roughly shaped as a rectangular solid. (5.4.3.2.6.3)				
11. The dimensions of the mouse controller are as follows (5.4.3.2.6.3): Width Min. 40mm (1.6 in.) Max. 70mm (2.8 in.) Length Min. 70mm (2.8 in.) Max. 120mm (4.7 in.) Thickness Min. 25mm (1.0 in.) Max. 40mm (1.6 in.)				
12. A discrete mechanism is provided for actuation/deactuation. (5.15.2.6.2)				

DESIGN CHECKLIST

Grid and Stylus (Sensor Tablets)

(9)

Test Title ______________________________

Test Project No. ____________________ **Date** ____________________

Detailed Design Considerations	YES	NO	N/A	Comments
1. Grid and stylus devices are used for graphic entry, not for hand-printed characters.				
2. Grids used as display overlays are the same size as the display. (5.4.3.2.5.3)				
3. The size of a displaced grid approximates the size of the display and is located below the display. (5.4.3.2.5.3)				
4. The orientation of the grid is the same as that of the display. (5.4.3.2.5.3)				
5. A follower is presented on the display that corresponds to the stylus. (5.4.3.2.5.1)				
6. Movement of the stylus causes a smooth, equal movement of the follower. (5.4.3.2.5.2)				

YES = Adequate **NO = Inadequate** **N/A = Not Applicable**

Grid and Stylus

Detailed Design Considerations	YES	NO	N/A	Comments
7. Refresh rate for the follower is sufficiently high to ensure the appearance of a continuous track for free-drawn graphics. (5.4.3.2.5.2)				
8. A discrete mechanism is provided for actuation/deactuation. (5.15.2.6.2)				

DESIGN CHECKLIST

Trackballs

(10)

Test Title ______________________________

Test Project No. ________________ Date ________________

Detailed Design Considerations	YES	NO	N/A	Comments
1. Trackballs are used only as position controls. (5.4.3.2.4.1)				
2. Trackballs are not used when an automatic return to center is needed. (5.4.3.2.4.1)				
3. Trackballs used for precise or continuous adjustments have wrist and/or arm support. This support is as follows (5.4.3.2.4.3): a. Large hand movements: elbow b. Small hand movements: forearm c. Finger movements: wrist.				
4. Trackball dimensions conform to the following (5.4.3.2.4.4): Diameter Min. 50mm (2 in.) Max. 150mm (6 in.) Preferred 100mm (4 in.) Surface Exposure Min. 1545 Mrad (100^{o}) Max. 2445 Mrad (140^{o}) Preferred 2095 Mrad (120^{o})				

YES = Adequate NO = Inadequate N/A = Not Applicable

Trackballs

Detailed Design Considerations	YES	NO	N/A	Comments
Resistance Precision Required Max. 1.0 N (3.6 oz.) Preferred 0.3 N (1.1 oz.) Vibration or Acceleration Conditions Max. 1.7 N (6 oz.) Clearance Display Clearance to Ball Clearance Min. 0 Max. 320mm (12.625 in.) Around Ball Min. 50mm (2 in.) Fall to Shelf Front Min. 120mm (4.75 in.) Max. 250mm (9.75 in.)				
5. Smaller diameter trackballs are used only where space is limited and precision is not required. (5.4.3.2.4.4)				
6. Trackballs are mounted on a shelf or desk top. (5.4.3.2.4.4)				
7. Trackballs are used to draw straight lines or circles.				
8. A discrete mechanism is provided for actuation/deactuation. (5.15.2.6.2)				

DESIGN CHECKLIST

Toggle Switches

(11)

Test Title ______________________________

Test Project No. ____________________ **Date** ____________________

Detailed Design Considerations	YES	NO	N/A	Comments
1. Toggle switches are used for two position functions. (5.4.3.1.4.1)				
2. Toggle switches with three positions are used only where the use of other switches is not feasible or when it is a spring return to center-off type. (5.4.3.1.4.1).				
3. Resistance gradually increases, then drops off when the control snaps into position. (5.4.3.1.4.3)				
4. The dimensions conform to those given below (5.4.3.1.4.3): Length <u>Use by Bare Finger</u> Min. 13mm (0.5 in.) Max. 50mm (2 in.) <u>Use with Heavy Handwear</u> Min. 38mm (1.5 in.) Max. 50mm (2 in.) Control Tip Diameter Min. 3mm (0.125 in.) Max. 25mm (1 in.) Resistance Min. 2.8 N (10 oz.) Max. 11 N (40 oz.)				

YES = Adequate **NO = Inadequate** **N/A = Not Applicable**

Toggle Switches

Detailed Design Considerations	YES	NO	N/A	Comments
Displacement __2 Position__ Min. 525 Mrad (30°) Max. 1400 Mrad (80°) __3 Position__ Min. 295 Mrad (17°) Max. 525 Mrad (30°) Preferred 435 Mrad (25°) Separation __Single Finger__ Min. 19mm (0.75 in.) Optimum 50mm (2 in.) __Single Finger w/Lever Lock__ Min. 25mm (1 in.) Optimum 50mm (2 in.) __Single Finger Sequential Operation__ Min. 13mm (0.5 in.) Optimum 25mm (1.0 in.) __Simultaneous Operation by Different Fingers__ Min. 16mm (0.625 in.) Optimum 19mm (0.75 in.)				
5. A positive indication of control activation is provided. (5.4.3.1.4.4)				

DESIGN CHECKLIST

Cursor

(12)

Test Title ____________________

Test Project No. ____________ Date ____________

Detailed Design Considerations	YES	NO	N/A	Comments
1. Cursor control dialogues are used for systems that use interactive graphics but also use menu selection.				
2. Cursor blink rate is 3 Hz.				
3. The cursor has a distinctive visual shape. (5.15.2.1.8.2)				
4. Cursors include a point designation feature when fine accuracy of positioning is required. (5.15.2.1.8.2)				
5. The cursor does not obscure any other character displayed in the designated position. (5.15.2.1.8.2)				
6. The cursor is stable and does not drift.				
7. The target for the cursor is at least 10 times the size of the positioning accuracy required for interactive graphics or 6mm (0.25 in.) square, whichever is smaller (e.g., the precision required does not hinder human performance).				

YES = Adequate NO = Inadequate N/A = Not Applicable

Cursor

Detailed Design Considerations	YES	NO	N/A	Comments
8. Cursor placement does not cause actual data entry.				
9. Multiple cursors are distinct from each other.				
10. Multiple cursors controlled by the same device provide a clear indication of which cursor is currently under control.				
11. Multiple cursors controlled by different devices have compatible controls.				
12. Cursor control is consistent with the speed and accuracy requirements of the operator. (5.15.2.1.8.1)				
13. If position designation is combined with keyed data input, cursor movement is controlled at the keyboard by function keys, joystick, etc.				
14. If position designation is the prime means of data entry, cursor placement is controlled by a direct-pointing device such as a lightpen.				
15. Continuous position designation is done by continuously operable controls.				
16. Cursors that are positioned incrementally by discrete steps have a step size for cursor movement that is consistent in both right				

Cursor

Detailed Design Considerations	YES	NO	N/A	Comments
and left directions and both up and down directions.				
17. For arbitrary position designation, the cursor control permits both fast movement and accurate placement.				
18. Rough cursor positioning takes no more than 0.5 seconds for a displacement of 200-300mm (8-12 in.).				
19. If displayed character size is variable, incremental cursor positioning has a step size that corresponds to the currently selected character size.				
20. Sequential cursor positioning in predefined areas is accomplished by programmable tab keys.				
21. If proportional spacing of displayed text is used, the software adjusts the cursor movement automatically for data entry or data change.				
22. User action, confirming entry of multiple data, results in input of all data, regardless of cursor location.				
23. Areas of the display that are not needed for data entry are inaccessible to the user by cursor placement.				

Cursor

Detailed Design Considerations	YES	NO	N/A	Comments
24. Cursor-predefined home position is consistently located for all displays and different windows of a partitioned display.				
25. Cursor home position is consistent across similar types of displays. (5.15.2.1.8.3)				

DESIGN CHECKLIST

Computer Visual Display Unit (VDU)

(13)

Test Title ______________________________

Test Project No. ____________________ **Date** ____________________

Detailed Design Considerations	YES	NO	N/A	Comments
1. Preferred distance for visual display unit (VDU) is 400mm (16 in.). (5.2.4.2)				
2. For short periods of VDU observation, or if dim signals must be detected, the viewing distance is not less than 250mm (10 in.). (5.2.4.2)				
3. The operator is able to view the screen from as close as desired. (5.2.4.2)				
4. If the viewing distance is 700mm (28 in.) and viewed by a single seat operator, the screen is 300mm (12 in.) in diagonal.				
5. For screens that must be viewed from greater than 400mm (16 in.), the screen size, symbol size, brightness range, line-pair spacing and resolution have been appropriately modified. (5.2.4.2)				

YES = Adequate **NO = Inadequate** **N/A = Not Applicable**

VDU

Detailed Design Considerations	YES	NO	N/A	Comments
6. VDU viewing angle: Optimum 90°; Minimum for seated viewer 45°; Absolute minimum 30°.				
7. Ambient illuminance in the VDU area is compatible with other necessary visual functions, but does not interfere with the visibility of signals on the screen. (5.2.4.6)				
8. Ambient illuminance doesn't contribute to more than 25% of screen brightness through diffuse reflection and phosphor excitation. (5.2.4.3)				
9. If the detection of faint signals is required and if the ambient illuminance is above 2.7 Lux (0.25 ft-c), the screen is hooded, shielded or recessed. (5.2.4.4)				
10. Reflected glare is minimal and does not interfere with readability. (5.2.4.7)				
11. Luminance range of surfaces immediately adjacent to the VDU is between 10% and 100% of the screen background luminance. (5.2.4.5)				

VDU

Detailed Design Considerations	YES	NO	N/A	Comments
12. With the exception of emergency indicators, no light source in the immediate surrounding area of the VDU has a greater luminance than the signals on the screen. (5.2.4.5)				
13. The adjacent surfaces to the VDU screen have a dull matte finish with a low reflectance. (5.2.4.8)				
14. The screen background luminance is between 78.8 cd/m^2 (23 ft-L) and 157.6 cd/m^2 (46 ft-L).				
15. If the VDU is used in both bright and dark environments, the alphanumeric character/screen brightness is variable between 0.2 cd/m^2 (0.058 ft-L) and 200 cd/m^2 (58.13 ft-L).				
16. The contrast of characters to background on the VDU screen is between 88% and 94%.				
17. Geometric and pictorial symbols subtend a minimum of 48 Mrad (16 minutes) of visual angle.				
18. Critical targets, or targets of complex shape that must be distinguished from nontargets of complex shape, subtend a visual angle of not less than 6 Mrad (20 minutes) and subtend not less than 10 scan lines per symbol height. (5.2.4.1)				

VDU

Detailed Design Considerations	YES	NO	N/A	Comments
19. Alphanumeric characters subtend not less than 3.6-4.5 Mrad (12-15 minutes) of visual angle.				
20. Alphanumeric characters are upper-case letters.				
21. Flight display alphanumerics subtend not less than 7.2 Mrad (24 minutes) of visual angle.				
22. Alphanumeric characters have a height-to-width ratio of between 7:5 and 3:2.				
23. Alphanumeric characters for airborne displays have a height-to-width ratio of between 2:1 and 1:1.				
24. Alphanumeric characters have a stroke width-to-height ratio of between 1:6 to 1:10. Light characters on a dark background have the thinner width.				
25. Red symbols on a green background are not used.				
26. Discernible flicker is avoided.				

DESIGN CHECKLIST

CRT-ARI

(14)

Test Title ______________________________

Test Project No. ______________ **Date** ______________

Detailed Design Considerations	YES	NO	N/A	Comments
1. Viewing distance is 400mm (16 in.). (5.2.4.2)				
2. For short periods of observation or when dim signals must be detected, viewing distance is 250mm (10 in.). (5.2.4.2)				
3. Pip subtends a visual angle of no less than 6 Mrad (20 minutes).				
4. ARI displays are 178mm (7 in.) in diameter if the target size is between 2 and 8mm (51 and 203 in.). If the target is between 12 and 16mm (305 and 406 in.), the display is between 300 and 400mm (12 and 16 in.).				
5. Ambient illumination is not greater than 0.1 ft-c. If the operator must perform other tasks, the ambient illumination is not brighter than 100 times the average brightness of the scope.				
6. The screen luminance is between 10 and 100 ft-L.				
7. The scanning rate for a 178mm (7 in.) screen is not less than 12 RPM.				

YES = Adequate NO = Inadequate N/A = Not Applicable

CRT-ARI

Detailed Design Considerations	YES	NO	N/A	Comments
8. The pip persists for a minimum of 0.1 second.				

DESIGN CHECKLIST

Dot Matrix/Segmented/LED Displays

(15)

Test Title ______________________________

Test Project No. ____________________ **Date** ____________________

Detailed Design Considerations	YES	NO	N/A	Comments
a. General				
1. Dot matrix characters are a minimum of 5 by 7 dots; 7 by 9 is preferred. (5.2.6.8.3)				
2. If there is symbol rotation, the characters have a minimum of 8 by 11 dots, with 15 by 21 being preferred. (5.2.6.8.3)				
3. Seven segment displays are only used for numeric characters. (5.2.6.8.2)				
4. Characters subtend a minimum of 4.7 Mrad (16 minutes) of visual angle. (5.2.6.8.4)				
5. Flight display characters subtend a minimum of 7 Mrad (24 minutes) of visual angle. (5.2.6.8.4)				
6. All alphanumeric characters are uppercase. (5.2.6.8.5)				
7. Dot matrix displays have a minimum viewing angle of 35° on the perpendicular axis. (5.2.6.8.6)				

YES = Adequate **NO = Inadequate** **N/A = Not Applicable**

Dot Matrix

Detailed Design Considerations	YES	NO	N/A	Comments
8. Monochromatic displays use the following colors, in order of preference: Green (555nm), yellow (575nm), orange (585nm), and red (660nm). Blue is not used. (5.2.6.8.7)				
9. A control for dimming is available. (5.2.6.8.8)				
10. Lamp testing capability is available unless the lights have a minimum of 100,000 hours MTBF. (5.2.6.8.9)				
11. The regeneration rate is high enough to preclude perceptible flicker.				
12. The screen luminance is a minimum of 21 ML (19.52 Ft-L) with a character-to-background contrast ratio of at least 8.5:1.				
13. A 0.75mm (0.03 in.) dot is used for reading tasks and a 1.5mm (0.06 in.) dot is used for search tasks.				
14. If both tasks are performed, the dot is between 1.0 and 1.2mm (0.04 and 0.048 in.).				
b. LED				
15. LEDs have dimming controls. (5.2.6.7.3)				
16. Red LEDs are not located in the proximity of red warning lights. (5.2.6.7.4)				

Dot Matrix

Detailed Design Considerations	YES	NO	N/A	Comments
17. LEDs have lamp testing capability unless their MTBF is 100,000 hours or more. (5.2.6.7.5)				

Dot Matrix

Detailed Design Considerations	YES	NO	N/A	Comments

DESIGN CHECKLIST

Printers

(16)

Test Title ______________________________

Test Project No. ______________ **Date** ______________

Detailed Design Considerations	YES	NO	N/A	Comments
1. The operator can obtain a paper copy of the exact contents of the alpha-numeric or digital graphic display. (5.15.9.2)				
2. Printed information is directly usable, with minimal requirements for decoding, transposing, and interpolating. (5.2.6.3.2)				
3. The printed material can be easily read (i.e., not obscured) (5.2.6.3.2).				
4. The luminance contrast between the printed material and the background is at least 75%. (5.2.6.3.3)				
5. If the printed material is not legible in the expected operational ambient illumination, the printer has internal illumination. (5.2.6.3.4)				
6. A take-up device for printed material is provided. (5.2.6.3.5)				

YES = Adequate **NO = Inadequate** **N/A = Not Applicable**

Printers

Detailed Design Considerations	YES	NO	N/A	Comments
7. The printer is mounted so that the printed matter can be easily annotated while still in the printer. (5.2.6.3.6)				
8. There is a positive indication of the remaining supply of paper, ink, or ribbon. (5.2.6.4.8B)				
9. The insertion, adjustment and removal of paper, the replenishment of the ink supply, the replacement of the pen, and other items determined to be operator tasks do not require disassembly, special equipment, or tools. (5.2.6.4.8C)				
10. The printed output is legible. (5.2.6.3.7)				
11. Printed tapes do not require any cutting and pasting to be read but are readable as they are received. (5.2.6.3.8)				

DESIGN CHECKLIST

Plotters and Recorders

(17)

Test Title ______________________________

Test Project No. ______________ **Date** ______________

Detailed Design Considerations	YES	NO	N/A	Comments
1. Plotters and recorders are used when a visual record of continuous graphic data is necessary. (5.2.6.4.1)				
2. Critical graphics are not obscured by any hardware. (5.2.6.4.2)				
3. A minimum of 50% luminance contrast is provided between the plotted function and the background. (5.2.6.4.3)				
4. A take-up device for the extruded plotting material is provided. ((5.2.6.4.4)				
5. Graphic overlays are provided if they are critical to proper interpretation of the graphic data. (5.2.6.4.5)				
6. These overlays do not obscure or distort the data. (5.2.6.4.5)				
7. The plot doesn't smudge or smear. (5.2.6.4.6)				

YES = Adequate NO = Inadequate N/A = Not Applicable

Plotters and Recorders

Detailed Design Considerations	YES	NO	N/A	Comments
8. The plotter or recorder paper can be written or marked on while in the equipment. (5.2.6.4.7)				
9. There is a positive indication of the remaining supply of plotting materials. (5.2.6.4.8b)				
10. The insertion, adjustment and removal of paper, replenishment of ink, replacement of pen or other items determined to be operator tasks can be performed without disassembly, special equipment, or tools. (5.2.6.4.8c)				

DESIGN CHECKLIST

Auditory Signals

(18)

Test Title ______________________

Test Project No. ______________ **Date** ______________

Detailed Design Considerations	YES	NO	N/A	Comments
1. Auditory signals are used to warn, alert, or cue the operator that an additional response is required. (5.3.1.1)				
2. Auditory signals are used to alert the user that an attempt has been made to enter data into a blank area rather than an entry field.				
3. Auditory signals are used to alert the operator to a critical change in system or equipment status. (5.3.2.1)				
4. False signals are avoided. (5.3.1.3)				
5. Failure of the computer system does not cause a failure of the auditory signal. (5.3.1.4)				
6. Auditory signals are testable. (5.3.1.5)				
7. Auditory signals used for warnings consist of two elements: an alerting signal and an identifying or action signal. (5.3.2.2)				

YES = Adequate **NO = Inadequate** **N/A = Not Applicable**

Auditory Signals

Detailed Design Considerations	YES	NO	N/A	Comments
8. Two element signals where reaction time is critical have an alerting signal of 0.5 second duration. (5.3.2.2.1)				
9. All essential information is conveyed in the first 2.0 seconds of a two-element signal. (5.3.2.2.1)				
10. Single-element signals where reaction time is critical convey all essential information in the first 0.5 seconds. (5.3.2.2.2)				
11. Caution signals are used to indicate conditions requiring awareness, but not necessarily immediate action. (5.3.2.3)				
12. Caution signals are easily distinguishable from warning signals. (5.3.2.2)				
13. The frequency range of auditory signals is between 200 and 5,000 Hz. (5.3.3.1.1)				
14. Auditory signals do not cause discomfort. (5.3.3.2.2)				
15. Signal-to-noise ratio of at least 20dB is provided in at least one octave band between 200 and 5,000 Hz. (5.3.4.1)				

Auditory Signals

Detailed Design Considerations	YES	NO	N/A	Comments
16. Signals of a high alerting capacity are used. (5.3.4.2.1)				
17. If different auditory signals are used, they are discriminably different. (5.3.4.3.1)				
18. For signals that require fast reaction time, the first 0.5 second is discriminable from the first 0.5 second of any other signal. (5.3.4.3.3)				
19. The action segment of an audible warning signal specifies the precise condition requiring action. (5.3.4.3.4)				
20. Auditory signals are consistent with established signals for that function. (5.3.4.4.1)				
21. Auditory signals do not interfere with other critical functions or auditory signals. (5.3.4.5.1)				
22. Audio signals used in conjunction with visual displays are: (5.15.3.9.3) a) Supplementary to the visual signals. b) Used to alert and direct the user's attention to the appropriate visual display.				

Auditory Signals

Detailed Design Considerations	YES	NO	N/A	Comments
23. The intensity, duration, and source location of the signal is compatible with the acoustical environment of the intended receiver as well as the requirements of other personnel in the signal area. (5.15.3.9.4)				
24. Signals are intermittent, allowing the user sufficient time to respond. (5.15.3.9.4)				
25. Signals are automatically terminated by operator response action or by manual control. (5.15.3.9.4)				

DESIGN CHECKLIST

Interactive Control

(19)

Test Title ____________________

Test Project No. ____________ **Date** ____________

Detailed Design Considerations	YES	NO	N/A	Comments
a. General				
1. Control actions selected from a discrete set of alternatives have those alternatives displayed prior to the time of selection. (5.15.4.1.5)				
2. The current value of any parameter with which the operator is interacting is displayed. (5.15.4.1.5)				
3. When an operator steps through multiple display levels (5.15.4.1.6):				
a. The number of required levels is minimized.				
b. The current position within the sequence of levels is provided.				
c. Display and input formats at each level are similar.				
4. Users are not required to learn mnemonics, codes, special or long sequences, and special instructions are minimized. (5.15.4.1.7)				

YES = Adequate **NO = Inadequate** **N/A = Not Applicable**

Interactive Control

Detailed Design Considerations	YES	NO	N/A	Comments
5. All operator control inputs result in a positive response displayed to indicate performance of requested actions. (5.15.4.1.5)				
6. When numeric data is displayed or required for control input, such data is in the decimal, rather than binary, octal, hexadecimal, or other number system. (5.15.4.1.9)				
7. The user is able to manipulate data without concern for internal storage and retrieval mechanisms of the system. (5.15.4.1.10)				
8. The sequence of transaction selections is generally dictated by the user's choices and not by internal computer-processing constraints. (5.15.4.1.11)				
9. An acknowledgement message to correct input is used only in those cases where the more conventional mechanism is not appropriate or where feedback response time must exceed 1 second. (5.15.4.1.12)				
10. When control input errors are detected, error messages are available and error recovery procedures are provided. (5.15.4.1.13)				

Interactive Control

Detailed Design Considerations	YES	NO	N/A	Comments
11. Correct user input causes logical and expected changes in state or value of the displayed data being controlled. (5.15.4.1.12)				
12. The presence and location of control input data entered by the user are clearly and appropriately indicated. (5.15.4.1.14)				
b. User Control				
13. In tasks where transaction sequences vary, the user is able to request a displayed list of previous entries to determine present status.				
c. Multiple Users				
14. Control inputs (5.15.4.6.4):				
a) Are simplified to the extent possible				
b) Permit logical task sequences with a minimum number of control manipulations to achieve task completion.				
15. If two or more users have simultaneous access to the system there is no interference between operations unless mission survival requires pre-emption. (5.15.4.6.5)				

Interactive Control

Detailed Design Considerations	YES	NO	N/A	Comments
16. Preempted operators can resume operations at a point of interference without information loss. (5.15.4.6.5)				
17. Commands are entered and displayed in a standard location on the display. (5.15.4.5.7)				
18. The information displayed to the user is limited to that which is necessary to perform specific actions or to make decisions. (5.15.4.6.2)				
19. In on-line communication among users, the input from each speaker is buffered to prevent any interference.				
20. Except for broadcast communication systems, the transmitter of each message in inter-user communications is identified automatically, if possible. (5.15.4.1.15)				
21. Separate areas of the display screen are provided for each communicator in inter-user communication.				
d. <u>Command Organization</u>				
22. Quantifiers and logical operators (e.g., and, or, not, implies, equivalence) in a command language are avoided.				

Interactive Control

Detailed Design Considerations	YES	NO	N/A	Comments
23. Global commands are provided only for data that are normally retrieved together (e.g., name, age, sex).				
e. <u>Command Language</u>				
24. The words chosen for a command language reflect the user's point of view and not the programmer's. (5.15.4.5.2)				
25. Abbreviations are distinctive to avoid confusion. (5.15.4.5.3)				
26. Command entries contain a minimum of punctuation or other special characters. (5.15.4.5.4)				
27. Abbreviations and acronyms are from MIL-STD-12, MIL-STD-411 and MIL-STD-783. New acronyms, if required, are developed using the rules of abbreviation in MIL-STD-12. (5.15.4.5.6)				
28. The command language allows the user to request prompts, as necessary, to determine required parameters in a command entry. (5.15.4.5.8)				
29. Distinct command names are used.				

Interactive Control

Detailed Design Considerations	YES	NO	N/A	Comments
30. Command language words are standardized in meaning and consistently used from one transaction to another and from one task to another.				
31. Each word has only one acceptable abbreviation.				
32. A standard delimiter (a special character used to denote boundary between adjacent syntactic components of a program), preferably a slash (/), is used.				
33. Blanks in command entries are verified and corrected by the computer, the user does not have to distinguish between one and multiple blanks.				
f. <u>Command Operation</u>				
34. Command operation is consistent throughout the system.				
35. Ease of command operation is compatible with the desired ends: frequent procedures are easy; destructive actions are difficult.				
36. Command sequencing is flexible and controlled by the user.				
37. Emergencies are automatically signaled to the user.				

Interactive Control

Detailed Design Considerations	YES	NO	N/A	Comments
38. The user is required to take a specific action to leave a command loop (e.g., text editing).				
39. Command entry requires the same actions as data entry or selection of menu options.				
40. If specific control options are not displayed in a defined transaction sequence, then a standard command is provided so that the user can continue to the next step.				
41. The user is able to return easily to previous steps in a transaction sequence.				
42. The user is able to change any data that are currently displayed, unless data security considerations are involved.				
43. Command sequencing never results in a dead-end for the user.				
44. If control input is accomplished by command entry, then the user has some consistent means to request prompting for options or control parameter values not already shown on the display.				
45. Users can control inputs directly at any step in a transaction sequence without having to return to a general options display.				

Interactive Control

Detailed Design Considerations	YES	NO	N/A	Comments
46. Stacking of input or multiple entries is allowed.				
47. In command stacking, the user's inputs are in the same order as they would normally be made in a succession of separate command entry actions.				
48. Users are allowed to use user-defined macros (labeled command sequences) for frequently used command sequences.				
49. The user can stop ongoing processing and regain immediate control at any time.				
50. A CANCEL option is provided, which has the consistent effect of regenerating the current display without processing any iterim changes made by the user.				
51. A RESTART option is provided, which has the consistent effect of returning to the first display in a defined transaction sequence, permitting the user to review a sequence of entries and make necessary changes.				
52. An END option is provided, which has the consistent effect of concluding a repetitive transaction sequence and returning control to a general options menu.				

Interactive Control

Detailed Design Considerations	YES	NO	N/A	Comments
g. System Response Time				
53. System response time conforms to Table XXIX of MIL-STD-1472C. (5.15.8)				
h. Form-Filling				
54. A form-filling dialogue is used when the user is entering commands which have been written or typed previously on a hardcopy form.				
55. For delayed entry, the user is required to enter a special symbol in the field to indicate that the missing item is delayed, not overlooked. (5.15.4.3.11)				
56. The program allows for orderly shutdown and est b-lishment of a check-poin to ensure restoration without loss of data. (5.15.4.6.3)				
57. Related items are grouped together. (5.15.4.3.2)				
58. A standard input form is used. (5.15.4.3.3)				
59. Fields or groups of fields are separated by lines, or other delineation cues. (5.15.4.3.4)				

AD-A165 326 SOLDIER-COMPUTER INTERFACE(U) ARMY TEST AND EVALUATION COMMAND ABERDEEN PROVING GROUND MD 30 NOV 85 TOP-1-1-059 2/3

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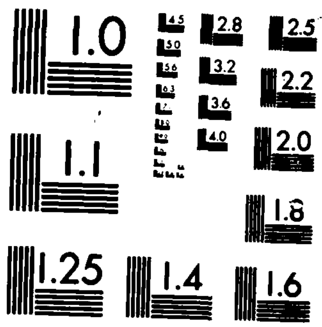

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Interactive Control

Detailed Design Considerations	YES	NO	N/A	Comments
60. Field labels are easily distinguishable from data entry. (5.15.4.3.5)				
61. Labels for data entry fields incorporate additional cueing of data format where the entry is made up of multiple inputs, e.g., DATE (M/D/Y): ____/____/____. (5.15.4.3.5)				
62. The cursor is advanced by a tab key to the next data entry field when the user has completed entry of the current field. (5.15.4.3.6)				
63. Data entry by overwriting a set of characters in a field (such as a default) is not used. (5.15.4.3.8)				
64. When the dimensional unit varies for a given field, it is provided, or selected, by the users. (5.15.4.3.10)				
65. The image of the form on the display screen looks like the hardcopy input form. (5.15.4.3.3)				
66. Optional fields are distinguished from required fields. (5.15.4.3.4)				
67. When an item length is variable, the user does not have to remove any unused underscores. (5.15.4.3.9)				

Interactive Control

Detailed Design Considerations	YES	NO	N/A	Comments
68. When required data entries have not been entered by the user but can be deferred, their omission is indicated, and either immediate or delayed input of the missing items is allowed. (5.15.4.3.11)				
69. Nonentry areas are designated. (5.15.4.3.12)				
70. Nonentry areas of the display are made inaccessible to the user via the cursor. (5.15.4.3.12)				
i. <u>Menu Selection</u>				
71. The system presents only menu selections for actions which are currently available. (5.15.4.2.3)				
72. Menus are presented in a consistent format throughout the system. (5.15.4.2.4)				
73. Menus are readily available at all times. (5.15.4.2.4)				
74. Menu selections are listed in a logical order, or, if no logical order exists, in the order of frequency of use. (5.15.4.2.5)				
75. Selection codes and associated descriptors are presented on single lines. (5.15.4.2.7)				

Interactive Control

Detailed Design Considerations	YES	NO	N/A	Comments
76. When menu selection is employed to train in the use of a command language, the wording and order is consistent with the command language. (5.15.4.2.9)				
77. Dependent or mutually exclusive options are grouped together.				
78. When options can be selected by coded entry, the code associated with each option is included on the display in some consistent, identifiable manner. (5.15.4.2.10)				
79. If menu selections must be made by keyed codes, options are coded by the initial letter or first several letters of their displayed labels. (5.15.4.2.11)				
80. Menu items are numbered beginning with one, not zero.				
81. At least one blank is used between the selection number and the text descriptor.				
82. Each menu frame presents a set of selectable items and a space for entering the item selected.				
83. The field for entering the selection code is separated from the menu items by at least one blank line.				

Interactive Control

Detailed Design Considerations	YES	NO	N/A	Comments
84. When the number of selections can fit on one page in no more than two columns, a simple menu is used. (5.15.4.2.6)				
85. When the user must step through a sequence of menus to make a selection, the hierarchic structure is designed, within the constraints of display space, to minimize the number of steps required.				
86. The current position in a hierarchical menu is indicated on the display.				
87. If selecting from a discrete set of options, these control input options are displayed at the time of selection.				
88. A standard location for the user to enter the code for the selected item is provided.				
89. An initial menu of control options is available for user selection.				

Interactive Control

Detailed Design Considerations	YES	NO	N/A	Comments

DESIGN CHECKLIST

Data Display

(20)

Test Title ____________________

Test Project No. ____________ **Date** ____________

Detailed Design Considerations	YES	NO	N/A	Comments
a. <u>Dynamic Displays</u>				
1. Changing alphanumeric values which the operator must reliably read are not updated faster than 1 per second. (5.15.3.4.1)				
2. Changing values which the operator uses to identify rate of change or to read gross values are not updated faster than 5 per second, nor slower than 2 per second when the display is to be considered as real time. (5.15.3.4.1)				
3. The rate of update is controllable by the user. (5.15.3.4.2)				
4. A display freeze mode is provided. (5.15.3.4.3)				
5. A display freeze option is provided to allow resumption at either point of stoppage or at the current, real-time point. (5.15.3.4.3)				
6. Feedback is provided to remind the operator when the display is in the freeze mode. (5.15.3.4.4)				

YES = Adequate NO = Inadequate N/A = Not Applicable

Data Display

Detailed Design Considerations	YES	NO	N/A	Comments
b. Information Coding				
7. Information coding (color, shape, blinking) is used to discriminate among different classes of items presented simultaneously on the display screen and to call attention to changes in the state of the system. (5.15.3.3.1)				
8. Coding is used for critical information, unusual values, changed items, items to be changed, high priority messages, special areas of the display, errors in entry, criticality of command entry, and targets. (5.15.3.3.1)				
9. Coding does not reduce legibility or increase transmission time. (5.15.3.3.1)				
10. Consistent, meaningful codes are used. (5.15.3.3.1)				
11. Brightness intensity coding is employed only to differentiate between an item of information and adjacent information. (5.15.3.3.3)				
a) No more than three levels of brightness are used.				
b) Each level is separated from the nearest by at least a 2:1 ratio.				

Data Display

Detailed Design Considerations	YES	NO	N/A	Comments
12. Pattern coding is employed to reduce operator information search time. (5.15.3.3.4)				
13. Color coding is employed where appropriate, to differentiate between classes of information in complex, dense, and critical displays. (5.15.3.3.7)				
14. The color selected agrees *in principle with those* specified for other visual tasks.				
15. Information is not coded solely by color if the data must be accessed from monochromatic as well as color terminals or printed in hardcopy versions. (5.15.3.3.7)				
16. The colors selected do not conflict with the color-association specified in Table II (MIL-STD-1472C). (5.15.3.3.7)				
17. Color coding is generally limited to three hues; the maximum is 10.				
18. Blink coding is used for alarms.				
19. Blink coding is not used with long persistence phosphor displays.				
20. The user is able to turn off the blinking.				

Data Display

Detailed Design Considerations	YES	NO	N/A	Comments
21. Flash coding is employed to call the operator's attention to mission critical events only. (5.15.3.3.2)				
22. No more than 2 flash rates are used. (5.15.3.3.2)				
23. Where one rate is used, the rate is between 3 and 5 flashes per second. (5.15.3.3.2)				
24. Where two rates are used, the second rate is less than 2 per second. (5.15.3.3.2)				
25. No more than 10% of the display is highlighted at one time.				
26. Alphanumeric coding is used when absolute identification is essential.				
27. Emergencies or adverse conditions do not degrade the interpretation of single or combination codes.				
28. Modifiers (additional geometric forms or lines) add status (e.g., engaged, heading, etc.) to the basic symbol.				
29. Modifiers do not cross, distort, obscure, or interfere with the basic symbol.				
30. No more than two basic symbols are combined to form a new or different symbol.				

Data Display

Detailed Design Considerations	YES	NO	N/A	Comments
31. Symbols are analogs of the event or system element they represent or are in general use and well known to the operators. (5.15.3.3.6)				
32. Where size difference between symbols is employed, the major dimensions of the larger are at least 150 percent of the major dimension of the smaller with a maximum of three size levels permitted. (5.15.3.3.6)				
c. Format				
33. Only data essential to the user's needs is displayed. (5.15.3.1.2)				
34. Data are presented to the operator in a readily usable and readable format. Requirements for transposing, computing, interpolating, or mentally translating into other units or numerical bases are avoided. (5.15.3.1.3)				
35. Recurring data fields within a system have consistent names and consistent relative position within displays. (5.15.3.1.6)				
36. Display formats are consistent within a system. (5.15.3.1.1)				

Data Display

Detailed Design Considerations	YES	NO	N/A	Comments
37. When appropriate for users, the same format is used for input and output. (5.15.3.1.1)				
38. Formats for data entry match the source document formats. (5.15.3.1.1)				
39. Essential data, text, and formats are always under computer, not user, control. (5.15.3.1.1)				
40. Frame identification conforms to the following (5.15.3.1.13):				
a) Every display frame has a unique identification.				
b) The frame identification is an alphanumeric code or an abbreviation which is dominently displayed in a consistent location.				
c. The frame identification is short enough (3-7 characters) and/or meaningful enough to be learned and remembered easily.				
41. When five or more digits and/or alphanumerics are displayed, and no natural (i.e., population stereotyped) organization exists, characters are grouped in blocks of 3-5 characters within each group. (5.15.3.1.7)				

Data Display

Detailed Design Considerations	YES	NO	N/A	Comments
42. Groups of information are separated by a minimum of one blank space or other separating character such as a hyphen or slash. (5.15.3.1.7)				
43. Each display is labeled with a title or label that is unique within the system. (5.15.3.1.9)				
44. Every field or column heading in a display is labeled. (5.15.3.1.9)				
45. Labels are displayed in upper-case only. (5.15.3.1.10)				
46. Each individual data group or message contains a descriptive title, phrase, word or similar device to designate the content of the group or message. Labeling conforms to the following (5.15.3.1.10):				
a. Labels are unambiguously applied to data groups or messages.				
b. Labels are highlighted or otherwise accentuated.				
c. Accentuated labels are easily distinguishable from those used to highlight or code emergency or critical messages.				
d. Labels are unique to preclude operator confusion.				

Data Display

Detailed Design Considerations	YES	NO	N/A	Comments
e. When presenting a list of operator options, the labels reflect the question being posed to the operator.				
f. Labels are located in a consistent fashion adjacent to the data group or message they describe.				
47. The units for every variable or column heading that is displayed are marked.				
48. Data fields are arranged in a naturally occurring order (e.g., sequentially, functionally, by importance, or by frequency). (5.15.3.1.4)				
49. Separation of groups of information is accomplished by blanks, spacing, lines, color coding, or other means consistent with the application. (5.15.3.1.5)				
50. Data fields to be compared on a character-by-character basis are positioned one above the other.				
51. At a minimum, the last four lines on each display page are reserved for messages, to indicate errors, communication links, or system status.				

Data Display

Detailed Design Considerations	YES	NO	N/A	Comments
52. Displays are designed so that information relevant to sequence control is distinctive in position and/or format.				
53. The home position for the cursor is consistent across displays.				
54. Frequently appearing commands appear in the same area of the display at all times.				
55. Important or infrequent messages and alarms are enhanced by being placed in the central field of vision relative to the display window.				
d. <u>Text/Program Editing</u>				
56. When inserting characters, words or phrases (e.g., editing), items to be inserted are collected in a buffer area and displayed in the prescribed insert area of screen for subsequent insertion by user command. (5.15.3.8.1)				
57. Display mode rather than line mode is used for text editing. (5.15.3.8.2)				
58. Tab controls or other provisions for establishing and moving from field to field are provided for editing programs and tabular data. (5.15.3.8.4.3)				

Data Display

Detailed Design Considerations	YES	NO	N/A	Comments
59. In text editing, the special commands (e.g., move, copy) are based on sentences, paragraphs, or higher- order segments. (5.15.3.8.4.1)				
60. In program editing, the special commands are based on lines or subprograms. (5.15.3.8.4.2)				
61. Program lines reflect a numbering scheme for ease in editing and error correction. (5.15.3.8.4.2)				
62. Easy to use, special editing commands, such as MOVE, COPY, and DELETE, for adding, inserting, or deleting text/program segments are provided. (5.15.3.8.4)				
63. Users are provided a means to search for groups of related files and to store the sorted collection into a new file for processing.				
64. In text editing, the user is able to search for synonyms and/or logical relations.				
65. If scrolling is incorporated for displaying portions of a large data base, standard commands for UP, DOWN, LEFT, and RIGHT are provided.				

Data Display

Detailed Design Considerations	YES	NO	N/A	Comments
66. ROLL and SCROLL commands refer to the display window, not the text/data; that is, the display window appears to the user to be an aperture moving over stationary text. (5.15.3.8.3)				
67. Scrolling is avoided when the user must discern a pattern (e.g., trend).				
68. When available, line-by-line syntax checking is under user control. (5.15.3.8.4.2)				
e. Display Content				
69. The content of displays within a system is presented in a consistent, standardized manner. (5.15.3.2.1)				
70. Information density is held to a minimum in displays used for critical task sequences. (5.15.3.2.2)				
71. Information is displayed in plain concise text wherever possible. (5.15.3.2.3)				
72. Entry codes without any contextual meaning to the operator, when used, are no longer than four alphabetic characters or five digits.				

Data Display

Detailed Design Considerations	YES	NO	N/A	Comments
73. Data entries longer than seven characters are partitioned into smaller symbol groups.				
74. Abbreviations and acronyms conform to the following (5.15.3.2.3):				
a) Abbreviations and acronyms conform to MIL-STD-12, MIL-STD-411, or MIL-STD-783.				
b) Words have only one consistent abbreviation.				
c) No punctuation is used in abbreviations.				
d) Definitions of all abbreviations, mnemonics, and codes are provided at the user's request.				
75. A minimum of one character space is left blank vertically above and below critical information with a minimum of two character spaces left blank horizontally before and after. (5.15.3.2.2)				
76. Irrelevant items can be eliminated from the display and recalled.				

Data Display

Detailed Design Considerations	YES	NO	N/A	Comments
f. Tabular Data				
77. When presented in tabular form, alphanumeric data are left-justified (5.15.3.5.3).				
78. Lists of numbers without decimals are right-justified. (5.15.3.5.3)				
79. Lists containing decimals use decimal alignment. (5.15.3.5.3)				
80. When tabular data are divided into classifications, the classification titles are displayed and subclassifications are identified. (5.15.3.5.4)				
81. When tabular data extend over more than one page vertically, the columns are titled identically on each page. (5.15.3.5.4)				
82. Tabular displays do not extend over more than one page horizontally. (5.15.3.5.5)				
83. Locations of recurring data are similar among all tabular data displayed and common throughout the system. (5.15.3.5.2)				
84. Tabular data are displayed in a left-to-right, top-to-bottom array. (5.15.3.5.3)				
85. Each item in a list starts on a new line. (5.15.3.5.6.1)				

Data Display

Detailed Design Considerations	YES	NO	N/A	Comments
86. Where lists extend over more than one display page, the last line of one page is the first line on the succeeding page. (5.15.3.5.6.2)				
87. Items in a list are arranged in some recognizable and useful order such as chronological, alphabetical, sequential, functional, frequency of use, or importance. (5.15.3.5.6)				
88. Tabular displays are broken into blocks whenever possible.				
89. Left- or right-justification of data entries and the justification of numeric lists on the decimal point are automatic.				
90. If a list extends beyond the amount that can be shown on one display page, a short message or symbol is provided to indicate that the list is not complete.				
91. In alphanumeric grouping, when a code consists of both letters and digits, common character types are grouped by common character type for ease of location. (5.15.3.5.8)				

Data Display

Detailed Design Considerations	YES	NO	N/A	Comments
92. Numeric punctuation conforms to the following (5.15.3.5.7):				
a) Long numeric fields are punctuated with spaces, commas, or slashes.				
b) Conventional punctuation schemes are used if in common usage. Where none exist a space is used after every third or fourth digit.				
c) Leading zeros are not used in numerical data except where needed for clarity.				
g. Textual Data Displays				
93. Textual data formats conform to the practices established for the particular type of textual data displayed; e.g., the format for display of specifications should conform to MIL-STD- 490. (5.15.3.7.2)				
94. Paragraphs are numbered. (5.15.3.7.3)				
95. Short simple sentences are used. (5.15.3.7.4)				
96. Paragraphs are separated by at least one blank line. (5.15.3.7.3)				

Data Display

Detailed Design Considerations	YES	NO	N/A	Comments
97. Text is displayed in a mixture of upper-case and lower-case letters, rather than in all upper-case. (5.15.3.7.5)				
98. Text is left-justified.				
h. Graphic Displays				
99. Graphic displays requiring operator visual integration of rapidly changing patterns are updated at the maximum refresh rate of the display device consistent with the operator's information handling rates. (5.15.3.6.3)				
100. The axes of graphs are always labeled. (5.15.3.6.4)				
101. When trend lines are to be compared, multiple lines are on a single graph. (5.15.3.6.5)				
102. The axes of graphs are graduated in accordance with MIL-STD-1472C, paragraphs 5.2.3.1.4, 5.2.3.1.5, 5.2.3.1.6. (5.15.3.6.4)				

DESIGN CHECKLIST

Data Protection/Error Management

(21)

Test Title ____________________

Test Project No. ____________________ **Date** ____________________

Detailed Design Considerations	YES	NO	N/A	Comments
a. Verification of Ambiguous or Destructive Actions				
1. Sign-on processes require minimum input from the user consistent with requirements prohibiting illegal entry. (5.15.7.5)				
2. User confirms aborts. (5.15.7.5)				
3. When a user signals for log-off, the system checks pending transactions to determine if data loss seems probable. If so, the computer prompt for confirmation before the log-off command is excecuted. (5.15.7.5)				
4. If data loss seems probable due to log-off, user must confirm before command is initiated (5.15.7.5).				
5. Erasing a file, permanently modifying data, or changing system operation requires user verification (5.15.7.5).				

YES = Adequate NO = Inadequate N/A = Not Applicable

Data Protection

Detailed Design Considerations	YES	NO	N/A	Comments
6. When command entries are subject to misinterpretation (as in the case of voice input), the user reviews and confirms the computer's interpretation of the command.				
7. Critical actions require more than one keystroke for verification.				
b. System Failures				
8. Automatic backups exist to restore files in case of a system crash.				
9. System failures do not cause errors to be entered into user data files.				
10. In the event of system failure, tasks can be performed using other methods or modes.				
c. Error Recovery				
11. The operator is able to stop his or her control process at any point in a sequence as a result of indicated error or as an option. (5.15.7.7)				
12. The operator is able to return easily to previous levels in multistep processes in order to correct an error or to make a desired change. (5.15.7.7)				

Data Protection

Detailed Design Considerations	YES	NO	N/A	Comments
13. The system permits correction of individual errors without requiring re-entry of correctly entered commands of data elements. (5.15.7.1)				
14. A capability is provided to facilitate detection and correction of errors before they are entered into the system. (5.15.7.2)				
15. Error checking occurs at logical data entry breaks, e.g., at the end of data fields rather than character-by-character. (5.15.7.2)				
16. Sessions are not terminated by user error.				
17. Escape from a partially completed procedure does not lead to incorrect or accidental modification of stored data or the initiation or modification of other system functions.				
18. User errors are minimized by use of internal software checks of user entries for (5.15.7.3): a) Validity of item b) Sequence of entry c) Completeness of entry d) Range of value.				

Data Protection

Detailed Design Considerations	YES	NO	N/A	Comments
19. The system requires the user to acknowledge critical entries prior to their being implemented by the system. (5.15.7.4)				
20. All error corrections by the user are acknowledged by the systems either by indicating a correct entry has been made or by another error message. (5.15.7.9)				
21. Error messages are constructive and neutral in tone, avoiding phrases that suggest a judgment of the user's behavior. (5.15.7.6)				
22. The error messages reflect the user's view. (5.15.7.6)				
23. Error messages are appropriate to the user's level of training and are as specific as possible to the user's particular application. (5.15.7.6)				
24. Computer-corrected commands, values, and spellings are displayed and highlighted for user confirmation. (5.15.7.10)				
25. To prompt for corrections of an error in stacked commands, the system displays the stacked sequence with the error highlighted. (5.15.7.11)				

Data Protection

Detailed Design Considerations	YES	NO	N/A	Comments
26. A procedure is provided to correct the error and salvage the stack. (5.15.7.11)				
27. When missing data are detected, the system prompts the user for these data. (5.15.7.5)				
28. When the missing data involve a relatively small set of alternatives, an argument list is provided for the user to select missing information.				
29. When the system detects an error, the cursor is automatically positioned at the field which contains the first error.				
30. *Correction of an error* requires an explicit action before the computer accepts the corrected inputs. (5.15.7.9)				
31. Error messages provide as much diagnostic information and remedial direction as can be inferred reliably from the error condition. (5.15.7.8)				
32. When errors occur in stacked commands, the command sequence is processed up to the error and then the user receives an indication of the problem and guidance to permit completion of the control input.				

Data Protection

Detailed Design Considerations	YES	NO	N/A	Comments

DESIGN CHECKLIST

Data Entry Procedures

(22)

Test Title ______________________________

Test Project No. ____________________ **Date** ____________________

Detailed Design Considerations	YES	NO	N/A	Comments
1. The display/data entry system indicates to the operator (5.15.2.1):				
a. Acceptance of an input.				
b. Inadmissability of an input.				
c. Existence of delay due to computer overload.				
2. Data entry is user-paced. (5.15.2.1.1)				
3. Data entries are validated by the system for correct format, legal value, or range of values. Where repetitive entry of data sets is required, data validation for each set is completed before another transaction can begin. (5.15.2.1.5)				
4. Special characters used in data entry (, * = /) are available without shifting from one case to another on the keyboard.				
5. Procedures for entering data are standardized.				

YES = Adequate NO = Inadequate N/A = Not Applicable

Data Entry Procedures

Detailed Design Considerations	YES	NO	N/A	Comments
6. Data entry requires an explicit completion action, such as the depression of an ENTRY key. (5.15.2.1.4)				
7. The user is not required to enter data already available to the software. (5.15.2.1.6)				
8. Data are entered in units familiar to the user. (5.15.2.1.7)				
9. Right- or left-justification of tabular data entries is not required by the user. (5.15.2.2.5)				
10. A single entry device is used to eliminate time spent switching among devices.				
11. When data entry is a significant task function, it is accomplished via the user's primary display.				
12. An easy means for correcting erroneous operator entries is provided. (5.15.7.1)				
13. In data entry, all required fields are placed before all optional fields.				

Data Entry Procedures

Detailed Design Considerations	YES	NO	N/A	Comments
14. If several levels of hierarchical menus are provided, a direct function call capability is provided such that the experienced user does not have to step through multiple menu levels. (5.15.4.2.8)				
15. Users are able to enter a series of menu selections (command stack) to speed the dialogue by avoiding the need to display each menu.				
16. Prompts are (5.15.6.4):				
a) Clear and understandable.				
b) Do not require reference to coding schemes or conventions which may be unfamiliar to occasional users.				
17. Input prompts are placed in a consistent screen location if possible.				
18. A special character is used to denote an input prompt. If possible, the character is reserved to use only as an input prompt.				
19. Currently defined default values are displayed automatically in their appropriate data fields with the initiation of a data entry transaction. (5.15.6.7)				

Data Entry Procedures

Detailed Design Considerations	YES	NO	N/A	Comments
20. A displayed cursor is positioned by the system at the first data entry field when the form is displayed. (5.15.4.3.6)				
21. Easy cursor movement is employed for movement from field to field as well as from line to line and character position to character position.				
22. Information necessary for the operator to select or enter a specific control action is available to the operator when selection of that control action is available (5.15.4.1.4).				
23. The maximum acceptable length for variable length fields is indicated. (5.15.4.3.7)				
24. Dimensions (e.g., size, speed, etc.) consistently associated with a data field are a fixed label and do not have to be entered by the user.				
25. Spelling and other common errors do not produce valid system commands or initiate transactions different from those intended. (5.15.7.10)				
26. The user is permitted to enter the full command name or an abbreviation for any command of more than 5 characters. (5.15.4.5.5)				

DESIGN CHECKLIST

Feedback

(23)

Test Title ______________________________

Test Project No. ____________________ **Date** ____________________

Detailed Design Considerations	YES	NO	N/A	Comments
a. General				
1. Feedback is provided to the operator to indicate the status of system functioning. (5.15.5.1) Feedback conforms to the following:				
a. During a delay the operator receives periodic feedback. (5.15.5.2)				
b. Positive indication is presented to the operator about the outcome of the process and the requirements for subsequent operator actions. (5.15.5.3)				
c. Selected items from a display are highlighted to indicate acknowledgement by the system. (5.15.5.6)				
d. Feedback is provided to indicate the reason for input rejection and the required corrective action. (5.15.5.7)				

YES = Adequate NO = Inadequate N/A = Not Applicable

Feedback

Detailed Design Considerations	YES	NO	N/A	Comments
e. Feedback is self explanatory. (5.15.5.7)				
2. Confirmation of user input occurs without removing the data display. (5.15.5.4)				
3. When multiple modes of operation are possible, some method is provided to remind the user of the current operating mode. (5.15.5.5)				
4. The log-on frame is presented immediately after connection regardless of user input.				
5. If the baud rate is less than 250 wpm (reading rate), more compact (i.e., shorter, more succinct) messages are used.				
6. Output abbreviations are avoided.				
7. Abbreviations used are consistent.				
8. Terminology inconsistent with user expectations is avoided.				
9. Alarm signals and messages are distinctive and consistent for each class of events.				
10. Both the old and new values are displayed simultaneously before stored data entry items are changed.				

Feedback

Detailed Design Considerations	YES	NO	N/A	Comments
11. A status message indicates the current functions of multiple-purpose special-function keys.				
12. Control values currently operative are displayed for user reference.				
13. Information concerning control options specifically appropriate at any step in a transaction sequence is provided for the user.				
14. Error messages appear as close physically as possible to the user entry that caused the error.				
b. Prompts				
15. Prompting messages are displayed in a standardized area of the displays. (5.15.6.2)				
16. Prompts and help instructions for system-controlled dialogue are explicit. (5.15.6.3)				
17. On-line documentation, off-line documentation, and help sequences use consistent terminology. (5.15.6.6)				
18. All error messages are listed and explained in the off-line system documentation.				
19. A dictionary of abbreviations and codes is available on-line. (5.15.6.5)				

Feedback

Detailed Design Considerations	YES	NO	N/A	Comments
20. After accessing help, the user is provided with an easy way to return to the main dialogue.				
21. Default values are used to reduce user workload. (5.15.6.7)				
22. The user indicates acceptance of the default. (5.15.6.7)				
23. The user has the option of generating default values based on operational experience. (5.15.6.8)				
24. The user can replace any default value during a transaction without changing the current default definition. (5.15.6.9)				
25. Users can accept stored data or default values by a simple means such as a single, confirming keystroke. (5.15.6.10)				
26. Prompting and structuring features conform to the following (5.15.7.5):				
a. When operating in special modes, the system displays the mode designation and file(s) being processed.				

Feedback

Detailed Design Considerations	YES	NO	N/A	Comments
b. Requests which would result in extensive, final and permanent changes to existing data require acknowledgement.				
c. System prompts for missing data.				

Feedback

Detailed Design Considerations	YES	NO	N/A	Comments

APPENDIX B
SAMPLE TASK CHECKLIST

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TASK CHECKLIST

Soldier-Computer Interface

Test Title ______________________________

Test Project No. ____________________ **Date** ____________________

Detailed Design Considerations	YES	NO	N/A	Comments
1. Load discs, tapes or other storage media				
2. Initialize system				
3. Boot program				
4. Display master menu				
5. Display subordinate menu				
6. Identify/select function from existing menu				
7. Call-up/display file				
8. Print file				
9. Create new file				
10. Edit file				
11. Delete/purge file				
12. Format data prior to input				
13. Input data				
14. Store/retrieve data				
15. Transmit/receive message via keyboard/screen				
16. Transmit/receive message via teletype/printer				

YES = Adequate NO = Inadequate N/A = Not Applicable

Soldier-Computer Interface

Detailed Design Considerations	YES	NO	N/A	Comments
17. Transmit/receive message via communications system				
18. Scroll screen forward/backward to preview/review content				
19. Transfer screen content to peripheral device (e.g., printer)				
20. Transfer screen content to other screen (i.e., intra- or inter-station transfer)				
21. Transfer data from one screen area to another				
22. Display log of recent activities				
23. Analyze/plot data				
24. Detect errors				
25. Determine cause of errors				
26. Correct errors				
27. Exit program				
28. Terminate session.				

APPENDIX C

SAMPLE SCI USER INTERVIEW GUIDE

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SCI USER INTERVIEW GUIDE

NAME ______________________________ RANK __________ DATE __________
(First) (M.I.) (Last)

MOS ______________________________ TIME IN MOS ____________________

WORKSPACE

1. Do you ever find that your work area is not arranged to aid you in performing your assigned tasks?

Yes ______

No ______

If yes, please explain: ______________________________________

____

____

____

____

2. Do you ever have difficulty reading displays, labeling, or documents because of poor lighting or glare?

Yes ______

No ______

If yes, please explain: ______________________________

____

____

____

____

3. Do you experience any arm, neck, or back fatigue while performing your assigned tasks?

Yes ______

No ______

If yes, please explain: ______________________________

____

____

____

____

INPUT AND OUTPUT DEVICES

1. Do the controls provide you with the speed and accurracy to input data and perform other assigned tasks?

Yes ______

No ______

If no, please explain: ______________________________

____

____

Do you feel that another type of control would be better?

Yes _______

No _______

If yes, what type and why: ______________________________

____

____

2. Can the information on the displays be easily read and interpreted?

Yes _______

No _______

If no, what causes the difficulty? ______________________________

____

____

What would make it easier? ______________________________

____

____

DATA DISPLAY

1. Do you always have enough information to do your job?

Yes ________

No ________

Please explain: ____

____

____

____

____

2. Are there ever times when the information presented is more than you used?

Yes ________

No ________

If yes, when? ____

Does this interfere with performing your job? Please explain: ____________

____

____

____

____

3. Is the organization of information displayed helpful for doing your job?

Yes ________

No ________

If not, what would you change and why? ______________________

____

____

____

____

4. Have you ever found information coding to be a problem?

Yes ______

No ______

If so, when? ______________________

____

____

____

____

5. Do the symbols used in this system ever confuse you?

Yes ______

No ______

If yes, which ones? Why? ______________________

____

____

____

____

6. Is there anything that you can think of that you don't like about the software?

Please explain: ____

____

____

____

____

USER INPUT

1. Have you ever had any problems entering data?

Yes ________

No ________

If yes, when? Please explain: ________________________________

____

____

____

____

2. Would you change anything about the way you enter data?

Yes ________

No ________

If so, what? Please explain: ________________________________

____

____

____

____

FEEDBACK AND ERROR HANDLING

1. Are the displayed messages ever confusing or difficult to remember?

   Yes ________

   No ________

   Please explain: ____________________

2. Do error messages give you enough information to correct your errors?

   Yes ________

   No ________

   Please explain: ____________________

3. Is there anything about the way the system handles errors or provides feedback that you would change?

   Please explain: ____________________

4. Can you always correct errors you have made while entering information into the computer?

Yes ________

No ________

Please explain: ____

5. Can you always return to your place in the program after seeking help?

Yes ________

No ________

Please explain: ____

INTERACTIVE CONTROL

1. Are the menus formatted so that you can quickly and easily select options?

Yes ________

No ________

Please explain: ______________________________

____

____

____

____

2. Can you always retrieve the information you need from the computer data base?

Yes ______

No ______

If not, please explain: ______________________________

____

____

____

____

3. Have you ever had any problems moving or positioning the cursor?

Yes ______

No ______

If yes, when? ______________________________

____

____

____

____

COMMAND METHODS

1. Is the command language confusing or difficult to use?

   Yes ________

   No ________

   If yes, when? ____

   ____
   ____
   ____
   ____

2. Are there enough computer commands which specify various functions to accomplish your job?

   Yes ________

   No ________

   If not, please explain: ____

   ____
   ____
   ____
   ____

3. Are there computer commands available that are not needed to accomplish your job?

   Yes ________

   No ________

If so, what are they? ______________________________

____

____

____

____

GENERAL

1. Are there any other comments regarding the usability of the soldier-computer interface which you would like to make?

Yes ________

No ________

If yes, what are they? ______________________________

____

____

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APPENDIX D

DEFINITIONS

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DEFINITIONS

Abort — A capability that cancels all user entries in a defined transaction sequence.

Address, direct — Specific location where instructions or data are stored.

Alphanumeric — Pertaining to a character set that contains both letters and numerals.

Analog — Similar or comparable.

Application — The system or problem to which a computer is applied. Reference is often made to an application as being either of the computational type, wherein arithmetic computations predominate, or of the data processing type, wherein data handling operations predominate.

Arithmetic and Logic Unit (ALU) — The part of the CPU logic chip that actually executes the operations requested by an input command is called the arithmetic and logic unit (ALU) since, in every case, some combination of arithmetic and/or logical operations is required. Another part of the CPU chip logic, the control unit, decodes the instruction (stored in the instruction register) in order to enable the required ALU logic and, thus, implement the arithmetic and/or logical operations required by the instruction.

Assembly Language — 1. A hardware-dependent symbolic language, usually characterized by a one-to-one correspondence of its statements with machine language instructions. 2. An assembler's source language.

ASCII — American Standard Code for Information Interchange. A standard 8-bit information code used with most computers and data terminals. It may be used in the parallel mode (all bits present simultaneously on separate lines) or the serial mode (one bit at a time on a single line).

Backup — A capability that returns the user to the first display in a defined transaction sequence.

Batch Processing — In computer terminology, batch processing refers to a specific method of processing in which a number of similar input items are grouped for processing during the same machine run.

Baud — A measure of the transmission speed capability of a communications line or system. In a sequence of binary signals, 1 Baud = 1 Bit/sec.

Binary — 1. A numbering system based on 2 which uses only the digits 0 and 1 when written. 2. A characteristic, property, or condition in which there are but two possible alternatives; e.g., the binary number system using 2 as its base and using only the digits 0 and 1.

Bit — A binary digit; hence, a unit of data in binary notation. In the binary numbering system, only two marks (0 and 1) are used. Each of these marks is called a binary digit.

Brevity — Information presented to the operator or entered by the operator is grouped into short, readily understandable units.

Buffer — An area of computer memory for temporary storage of an input or output record.

Bug — Any mechanical, electrical, or electronic defect that interferes with or bugs up the operation of the computer. It can also be a defect in the coding of the program.

Bus — A set of parallel wires over which data is communicated. Buses may be internal to a processor, may connect a processor to main or secondary memory, or may connect a computer system to outside peripherals.

Byte — 1. A generic term to indicate a measurable portion of consecutive binary digits; e.g., an 8-bit byte. 2. A sequence of adjacent binary digits operated upon as a unit and usually shorter than a word.

Cancel — A capability that regenerates (or re-initializes) the current display without processing any entries or changes made by the user.

Cathode ray terminal, CRT — A terminal which has a keyboard for data input and a display screen. Also used to describe a type of terminal in which an electronic vacuum tube energizes phosphors on a screen.

Central processing unit (CPU) — The unit of a computing system that contains the circuits that control and perform the execution of instructions.

Character — The actual or coded representation of a digit, letter, or special symbol but not a space.

Code — A system of symbols and rules for use in representing information.

Command — A pulse, signal, or set of signals that occur in a computer as the result of an instruction and which initiate one step in the process of executing the instruction. From the user's perspective, the instruction or request used to initiate a computer action.

Command Language — A type of dialogue in which the user formulates control entries with minimal prompting by the computer.

Command Stacking — The process of queuing up multiple commands before execution. The computer then executes the commands in seqence without requiring any interaction by the operator.

Communication — The process of transferring information in the various media from one point, person, or device to another.

Compatibility — A system is compatible to the extent that workspace, input and output devices, and software accommodate user needs.

Compiler — A compiler is a translator whose source language is a problem-oriented language and whose target language is either a numerical machine language or a symbolic representation for one.

Computer — A device capable of accepting information, applying prescribed processes to the information, and supplying the results of these processes. It usually consists of input and output devices, storage, arithmetic and logical units, and a control unit.

Consistency — Extent to which the code of the system contains uniform notation, terminology, and symbology within itself, and external consistency to the extent that the content is traceable to the requirements.

Control action — An action taken by the user to alter the state of the system.

CRT — See cathode ray terminal.

CRT-ARI — This is a cathode ray tube used for indicating the azimuth and range of a target. It is typically used on radar systems and used to be called PPI (plane position indicator).

Cursor — The cursor on the VDT screen is a position-marking symbol, such as solid block or underscore. It may blink or be brighter than other symbols to identify its location easily. It shows the "current" item for attention, which may designate a displayed item. The cursor may be positioned under computer control or moved by the user through the keyboard.

Cursor control keys — In text display applications, the cursor control keys may be used to relocate the cursor to a desired position.

Data — A general term used to denote any or all facts, numbers, letters, and symbols that refer to or describe an object, idea, condition, situation, or other factors. It connects basic elements of information which can be processed or produced by a computer. Sometimes data are considered to be expressible only in numerical form, but information is not so limited.

Data processing — 1. Any procedure for receiving information and producing a specific result. 2. Rearrangement and refinement of raw data into a form

suitable for further use. 3. The preparation of source media which contain data or basic elements of information, and the handling of such data according to precise rules of procedure to accomplish such operations as classifying, sorting, calculating, summarizing, and recording. 4. The production of records and reports.

Database — The collection of information or data that is stored in the central computer for relatively long periods of time.

Database management — A systematic approach to storing, updating, and retrieval of information stored as data items, usually in the form of records in a file, where many users, or even many remote installations, will use common data banks.

Data Display — Output of data from a computer to its users. Generally, this phrase denotes visual output, but it may be qualified to indicate a different modality, such as an "auditory display".

Data Entry — User input of data from paper documents to computer-based records for computer processing.

Data field — An area of the display screen reserved for user entry of a data item.

Data field label — An area of the display screen that serves as a prompt for entering a data item. It usually cannot be changed by a user.

Data store — The part of a terminal in which received data is held during operation. A method of storing data, usually in binary coded form.

Debug — 1. To locate and correct any errors in a computer program. 2. To detect and correct malfunctions in the computer itself. 3. To test a program on a computer to find whether it works properly. If mistakes are revealed, they must be traced to their source and corrected.

Default value — A predetermined, frequently used, value for a data or control entry, intended to reduce required user action.

Delete — The ability to remove extraneous or erroneous material from screen or memory, simultaneously eliminating the gaps which would otherwise be formed.

Delimiter — A special character used to denote a boundary between adjacent syntactic components of a program; for example, a slash(/).

Dialogue — A structured series of interchanges between a user and a computer terminal. Dialogues can be computer-initiated, e.g., question and answer, or user-initiated, e.g., command language.

Digit, binary — A whole number in the binary scale of notation; this digit may only be 0 (zero) or 1 (one). It may be equivalent to an "on" or "off" condition, a "yes" or a "no," etc. The word "bit" is a contraction of binary digit.

Disk — A circular metal plate with magnetic material on both sides, continuously rotated for reading or writing by means of one or more read/write heads mounted on movable or fixed arms; disks may be permanently mounted on a shaft, or as a package, they may be removable and others placed on the shaft.

Diskette — A thin, flexible platter (floppy disk) coated with magnetic material used as the storage medium in a floppy disk unit.

Display coding — A means of highlighting displayed segments such that one segment is differentiated from other segments.

Dot matrix characters — Character images on a CRT display screen that are represented by rectangular cells composed of dots arranged in rows and columns from which characters can be composed by causing some of the dots to glow, while permitting others to remain dark.

Encode — To apply a code, frequently one consisting of binary numbers, to represent individual characters or groups of characters in a message.

Enter — An explicit user action that affects computer processing of user entries. For example, after typing a series of numbers, a user might press a specially marked ENTER key that will add them to a data base, subject to data validation.

Feedback — A response from the system which informs the user of the status of the current request or command.

Field — A set of characters of fixed or variable length that form a single unit of data entry.

File — A collection of related records treated as a unit. In a computer system, a file can exist on magnetic tape, disk, punched paper tape, punched cards, or as an accumulation of information in system memory. A file can contain data, programs, or both.

Firmware — Refers to computer programs that are encoded permanently into a ROM (read-only memory). These programs are referred to as microprograms, and cannot be altered or erased. Contrasted with software, which refers to the entire set of programs, procedures, and related documentation associated with a computer system. Common examples of firmware are microcomputer operating systems and video game cartridges.

Fixed Field — An input or output area that always contains a certain set number of characters. An example is the date which is always MM/DD/YY.

Fixed function key — A function key that is not readily changeable.

Flexibility — A system is flexible to the degree that individual differences in skill are encompassed to ensure optimal performance of all users under all anticipated conditions.

Flicker — The sensation of brightness or color variation caused by the perceived dimming and brightening of the character images as they are refreshed on the display screen.

Floating point — A notation in which a number x is represented by a pair of numbers y and z (and two integers n and m which are understood parameters in any given representation) with y and z chosen so that $x = y \cdot n^z$ where z is an integer. The quantity z is called the exponent or characteristic; e.g., a decimal number 241,000,000 might be shows as 2.41,8, since it is equal to 2.41×10^8.

Format — A predetermined arrangement of characters, fields, lines, punctuation, page numbers, etc.

Formatting — The structuring of the display screen into protected and accessible areas within which various actions can be performed in fields.

Form filling — The entering of information into predefined areas or fields in the display screen. The user fills out a form or questionnaire presented at the terminal. Appropriate for buffered terminals only.

Function keyset — A collection of keys, each of which is associated with a specific command.

Glare — A visual condition caused by excessive luminance variations within the field of vision, e.g., when bright sources of light such as windows or lamps or their reflected images fall in the line of sight.

Graphic display — Display of data in the form of lines, shapes, and symbols such as graphs, histograms, maps, etc.

Hard Copy — A printed paper copy of the information displayed on the display screen.

Hardware — The physical equipment which makes up a computer system, e.g., CPU, terminals, and other input/output (I/O) and storage devices. As opposed to the programming software.

Help — A capability that displays information upon user request for on-line guidance. HELP may inform a user generally about system capabilities, or may provide more specific guidance on what to enter in the field currently indicated by the cursor.

Hierarchical — Arranged in a set of levels; tree-structured.

High level language — A computer programming language which uses symbols and English-like command statements an operator can read. Each statement typically represents a series of computer instructions, and provides constructs for conditional statement execution, looping, and often nested or recursive subroutines. Examples of high-level languages are BASIC, Pascal, FORTRAN, and COBOL. High-level languages are usually compiled.

Illuminance — The amount of light falling on a surface. Measured in units of Lux (lx) or foot candles (ft-C).

Input — 1. Information or data transferred or to be transferred from an external storage medium into the internal storage of the computer.
2. Describing the routines with direct input as defined in (1), or the devices from which such information is available to the computer. 3. The device or collective set of devices necessary for input as defined in (1).

Input devices — Devices that convert facts into electronic impulses.

Input/output — 1. Commonly called I/O. A general term for equipment used to communicate with a computer. 2. The data involved in such communication.
3. The media carrying the data for input/output. 4. The process of transmitting information from an external source to the computer or from the computer to an external source.

Insert Area — The physical area of the screen where data is displayed prior to entry into the data base.

Instruction — A coded program step that tells the computer what to do for a single operation in a program.

Interface — An electronic device which enables one piece of equipment to communicate with or control another. A shared boundary.

Joystick — (Also called syntaxer.) A movable handle which a human operator may grasp and rotate to a limited extent in one or more degrees of freedom, and whose variable position or applied force is measured and results in commands to a control system. Isotonic joysticks operate by displacement and isometric joysticks operate by applied force, not movement.

Keyboard — For the purposes of this TOP, this is any computer input device that utilizes keys. This includes alphanumeric keyboards, keypads, and control panels composed of legend switches.

Keypad — A small keyboard or section of a keyboard containing a smaller number of keys, generally those used on simple calculators. These 10-, 12-, or 16-key units are often the simplest input devices to microcomputers or function as an extension of ASCII keyboards to permit more extensive computational capability.

Label — One or more characters used to identify a statement or an item of data in a computer program.

Languages — Software framework of commands for writing a program.

Left-justify — To display data in columns such that the first character of each row is aligned vertically.

Luminance — The amount of light emitted by a light source. Measured in candela per meter^2 (cd/m^2) or foot lamberts (ft-L).

Machine code — The absolute numbers, names, or symbols assigned by the machine designer to any part of the machine. Same as operation code.

Machine cycle — 1. The specific time interval in which a computer can perform a given number of operations. 2. The shortest complete process of action that is repeated in order. 3. The minimum length of time in which the foregoing can be performed.

Machine language — A set of symbols, characters, or signs, and the rules for combining them, that conveys instructions for information to a computer.

Macro command — An instruction in a source language that is equivalent to a specified sequence of machine instructions.

Magnetic bubble storage — The storage medium of a bubble memory is a very thin layer of magnetic garnet material. This material has ribbon-shaped stripes (magnetic domains) in its natural state. When an external magnetic field is applied to the material, the domains contract into stubby cylinders, which look and behave like bubbles when viewed from the top through a microscope. Under the influence of external fields, the bubbles are manipulated to represent information bits.

Main memory — Usually the fastest storage device of a computer and the one from which instructions are executed. (Contrasted to auxiliary storage.)

Memory — The part of a computer, internal to the CPU, where programs and data are stored.

Menu — A collection of items, e.g., a list or directory of the contents of a given file, from which the operator may select. The selection may be made by entering a code, word, or number associated with the selection.

Microcomputer — A general term referring to a complete tiny computing system, consisting of hardware and software, whose main processing blocks are made of semiconductor integrated circuits. In function and structure, it is somewhat

similar to a minicomputer, with the main difference being price, size, speed of execution, and computing power. The hardware of a microcomputer consists of the microprocessing unit (MPU), which is usually assembled on a printed circuit board with memory and auxiliary circuits. Power supplies, control console, and cabinet are separate.

Microprogram — Computer instructions which do not reference the main memory. Microprogramming is a technique to design subroutines by programming very minute computer operations. As regards microprocessors, microprograms can implement a higher language program by storing microinstructions in ROM.

Minicomputer — The older minicomputers were parallel binary systems with 8-, 12-, 16-, 18-, 24-, or 32-bit word lengths incorporating semiconductor or magnetic core memory offering from 4K words to 64K words of storage and a cycle time of 0.2 to 8 microseconds or less. These units were characterized by higher performance than microcomputers or programmable calculators, richer instruction sets, higher price and proliferation of high-level languages, operating systems, and networking methodologies.

Mixed variable — See alphanumeric.

Multiuser — A system which permits multiple users to access the same system in a time-sharing mode via "time slicing" interrupts of the single CPU or via use of satellite CPUs.

Numeric keypad — An arrangement of the 10 numeric keys in the standard telephone arrangement, 1, 2, 3 across top row; 4, 5, 6 in second row; 7, 8, 9 in third row; with 0 on the bottom row.

Numeric variable — Indicates that only numbers are allowed in the variable. A decimal point (or period) may be a part of a numeric variable, but all other printing characters are considered alphabetic or alpha.

Op code — In machine language, a binary number that represents an instruction to the central processing unit. During execution, the op code is fetched from

memory into the instruction register where the microprocessor recognizes it as a command, and one of the computer's functions is carried out. Op codes are frequently accompanied by operands such as memory addresses, numeric constants, etc.

Operand — Any one of the quantities entering into or arising from an operation. An operand may be an argument, a result, a parameter, or an indication of the location of the next instruction.

Operating system — A collection of computer programs that control the overall operation of a computer and perform such tasks as assigning places in memory to programs and data, processing interrupts, scheduling jobs, and controlling the overall input/output of the system.

Output — The results of a computer program action that is sent to a display, printer, or other device.

Output devices — The part of a machine that translates the electrical impulses representing data processed by the machine into permanent results such as printed forms, punched cards, and magnetic writing on tape or disk.

Packed decimal — A system means of data representation. Two digits per character can be used to increase speed and capacity in fields where alphabetics and special characters are not being used.

Page — The information appearing at one time on a single display screen.

Parameter — A quantity or constant whose value varies with the circumstances of its application. A quantity with variable values used in determining other variables.

Peripheral devices — Various kinds of machines that operate in combination or in conjunction with a computer but are not physically part of the computer. Peripheral devices typically display computer data, store data from the computer and return the data to the computer on demand, prepare data for human

use, or acquire data from a source and convert it to a form usable by a computer.

Phosphor — A coating of luminescent material which emits visible light when struck by a beam of electrons within an evacuated glass tube such as a CRT.

Problem-oriented language — 1. In a computer, a source language suited to describing procedural steps in machine computing. 2. A language designed for convenience of program specification in a general problem area rather than for easy conversion to machine instruction code. The components of such a language may bear little resemblance to machine instructions. 3. A machine-independent language where one needs only to state the problem, not the how of solution.

Program — Set of instructions for handling data that is input into the system

LEVELS: a — languages are used to write programs.
b — programs combine to handle a specific application

Protected Field — The part of the display that cannot be changed by action at the keyboard. Protected fields are used to provide headings and labels for the fields that require data entry. When positioning the cursor, it skips over protected fields.

RAM — Acronym for random-access memory. This type of memory is random because it provides access to any storage location point in the memory immediately by means of vertical and horizontal coordinates. Information may be "written in" or "read out" in the same very fast procedure.

Real time — In solving a problem, a speed sufficient to give an answer within the actual time the problem must be solved.

Record — A set of one or more consecutive fields on a related subject, as an employee's payroll record. Although a record need not be a block in length, such an arrangement is often useful.

Reflectance — The ratio between the quantity of light that is reflected from a given surface and the total quantity of light that is incident on the same surface.

Reflected glare — A glare condition caused by the reflection of bright sources of light, e.g., windows, luminaires, etc., from illuminated surfaces within the field of vision.

Refresh — A technique used to regularly energize the phcsphor coating in the CRT in order to ensure an apparently continuous and stable, but in fact transient image.

Refresh rate — The frequency with which the image on the face of the CRT is refreshed.

Response time — The elapsed time between the generation of an inquiry at a data terminal and the receipt of the response at the same terminal.

Rever ɘd video — A style of video display in which characters are shown as dark strokes on a light background. This is just the reverse of the more common video display, which uses light characters on a dark background.

Right justify — To display data in columns such that the last character of each row is aligned vertically.

ROM — Acronym for read-only memory. A semiconductor memory device where information is stored permanently or semipermanently and can be read out, but not altered in operation. A blank ROM can be considered to be a mosaic of undifferentiated cells. Many types of ROMs exist. A basic type of ROM is one programmed by a mask pattern as part of the final manufacturing stage. PROMs are "programmable" ROMs and are relatively permanent, although they can be erased with the aid of an ultraviolet irradiation instrument. Others can be electrically erased and are called EPROMs.

Screen format — The structure or layout of a visual display, e.g., column text format (narrative), tabular, divided into protected and unprotected areas, etc.

Scrolling — This is where information is recalled from the display memory and displayed on the CRT. There are three basic types of scrolling: line, screen, and page. In line scrolling, the information is updated on the screen one line at a time. In screen scrolling, information is updated for the visible screen. If the system is designed properly, a part of the old screen remains as a reference. In page scrolling, an entire page is updated. A page is usually more information than is visible to the operator on the display.

Simplicity — A system contains the quality of simplicity to the extent that information presented to the operator or entered by the operator is grouped into short, readily understandable structures.

Software — The term for all programs that run on the computer.

Source language — Source language is the language in which the programming has been written, such as FORTRAN and COBAL. This is usually transparent to the user.

Storage — A device capable of receiving data, retaining them for an indefinite period of time, and supplying them upon command.

System — Computer plus its output devices, input devices, connectors, modems, and software.

Tabular display — Data presented in row/column format.

Terminal — An input-output (I/O) device for transmitting or receiving data on a communication line. Data are usually entered via a keyboard, and are usually displayed via a video screen or printer.

Text editor — A text editor provides the system user with a convenient and flexible source text generation system. Source statements are entered via any source input device/file, and the entered text may be output or statements added, deleted, or modified. The text editor permits the order of statements or groups of statements to be altered at any time. The final text is output to a source device/file for use as input to an assembler.

Time sharing — A computing technique by which more than one terminal device can use the input, processing, and output facilities of a central computer simultaneously.

Translate — To change information from one language to another without significantly affecting the meaning; e.g., problem statements in pseudocode, data, or coding to machine.

User — Any person who uses an information system in performing his/her job.

Variable — A quantity that can assume any of a given set of values.

Variable Field — An input or output area for which the exact number of characters cannot be specificed in advance. Instead the limit on the number of characters is specified. An example is number of bushels of a commodity.

Variable function key — A function key that is readily changeable, e.g., keys that are displayed electronically on a CRT.

Word/byte/nibble — These terms are often misused in describing microprocessor data. For a specific microprocessor, a word is the number of bits associated with the instruction or data length. This can be 4 bits, 8 bits, 16 bits, etc., depending on the machine. A byte specifically refers to an 8-bit word; a byte can be manipulated by a 4-, 8-, or 16-bit microprocessor. For example, instructions are often provided to deal with byte data in 4- or 16-bit processors. This is called byte handling, and is independent of the natural word size of the machine. A nibble is 4 bits, and it takes 2 nibbles to make a byte. Nibble (or 4-bit) control can be found on many 8-bit word machines as

well as one some 16-bit machines. Four-bit operations are usually associated with hexadecimal (HEX) or binary coded decimal (BCD) operations.

Workload reasonability — A system has a reasonable workload to the extent that the tasks required by the operator are within the operator's capability and require the operator to perform a useful, meaningful role.

APPENDIX E
CHECKLIST CRITERIA CROSS-REFERENCE

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REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
29.									P.241						P.40	
30.									P.241							
31.									P.241						P.41	
32.															P.40	
33.														P.66		
34.															P.41	
35.				P.51												
36.				P.51												
37.				P.51												
38.				P.51												
39.														P.65		
40.															P.41	
41.									P.240							
42.									P.241							

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Elke et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
KEYPADS - ALPHANUMERIC																
1.									P.90							
2.									P.90							
3.									P.90							
4.									P.90							
5.									P.90							
6.									P.90							
7.									P.90							
8.									P.90							
9.									P.240							
10.											P.40					
11.									P.247h							
12.									P.240							
13.									P.240					P.66		
14.														P.66		
15.				P.51												
16.									P.92							

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
17.									P.92							
18.									P.95							
19.									P.95							
20.									P.95							
21.									P.241					P.66	P.41	
22.				P.51												
23.				P.51												
24.				P.51												
25.				P.51												
26.															P.41	
27.									P.241						P.41	

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
LIGHT PENS																
1.									P.241							
2.													P.42			
3.									P.241							
4.									P.110							
5.									P.110							
6.									P.241							
7.									P.107							
8.									P.107							
9.									P.107							
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General																
1.									P.242							
2.									P.104							
3.									P.242							

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Elke et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
Isotonic																
4.									P.104							
5.									P.104							
6.									P.104							
7.									P.104							
8.									P.104							
9.									P.104							
10.									P.104							
11.									P.104							
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13.									P.104							
14.									P.104							
15.									P.106							
16.									P.106							
17.									P.106							

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Elke et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
PRINTED CIRCUIT SWITCHES																
1.									P.101							
2.									P.101							
3.									P.101							
4.									P.101							
5.									P.101							
6.									P.101							
7.									P.101							
8.									P.101							
9.									P.101							
10.									P.101							
11.									P.102							

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
MOUSE																
1.								P.109								
2.								P.109								
3.								P.109								
4.								P.109								
5.								P.109								
6.								P.109								
7.								P.109								
8.								P.109								
9.								P.109								
10.								P.109								
11.								P.109								
12.								P.242								

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Elke et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
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1.															P.43	
2.									P.107							
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4.									P.107							
5.									P.107							
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1.									P.106							
2.									P.106							
3.									P.107							
4.									P.107							
5.									P.107							
6.									P.107							

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
7.															P.43	
8.									P.242							
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1.									P.92							
2.									P.92							
3.									P.92							
4.									P.92							
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2.																Rouse, 1975, P.849
3.									P.239							
4.									P.239						P.42	
5.									P.239						P.42	
6.															P.41	

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Elke et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
7.															P.42	
8.															P.42	
9.															P.42	
10.															P.42	
11.															P.42	
12.										P.239						
13.														P.44		
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21.															P.41	
22.														P.45		
23.														P.45		
24.														P.43		
25.										P.239						

CRITERIA	REFERENCE DOCUMENT															
	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
VISUAL DISPLAY UNIT																
1.									P.40							
2.									P.40							
3.									P.40							
4.				P.25												
5.									P.40							
6.				P.24												
7.									P.41							
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9.									P.40							
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11.									P.40							
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13.									P.41							
14.																Rouse, 1975, P.848
15.						P.266										
16.																Rouse, 1975, P.848

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
17.				P.22												
18.									P.40							
19.				P.22												
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21.				P.22												
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1.				P.30					P.40							
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AD-A165 326 SOLDIER-COMPUTER INTERFACE(U) ARMY TEST AND EVALUATION COMMAND ABERDEEN PROVING GROUND MD 30 NOV 85 TOP-1-1-059 3/3

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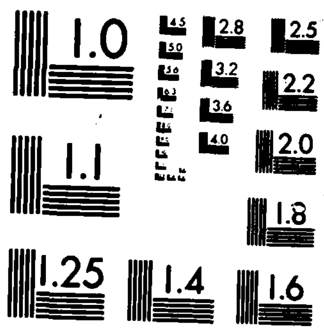

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
7.					P.31											
8.					P.30											
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1.									P.48							
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10.									P.49							
11.					P.37											
12.					P.37											

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
13.				P.36												
14.				P.36												
15.									P.48							
16.									P.48							
17.									P.48							
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1.									P.247j							
2.									P.43							
3.									P.43							
4.									P.43							
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8.									P.44							
9.									P.44							
10.									P.44							
11.									P.44							

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
PLOTTERS & RECORDERS																
1.									P.44						P.29	
2.									P.44							
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1.									P.51						P.29	
2.																
3.									P.51							
4.									P.51							

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Elke et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Mill & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
5.									P.51							
6.									P.51							
7.									P.51							
8.									P.53							
9.									P.53							
10.									P.53							
11.									P.53							
12.									P.53							
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19.									P.55							
20.									P.56							
21.									P.56							
22.									P.247a							

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
23.									P.247a							
24.									P.247a							
25.									P.247a							
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General																
1.									P.247a							
2.									P.247a							
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5.									P.247g							
6.									P.247b							
7.									P.247b							
8.									P.247b			P.16		P.70		
9.									P.247b							
10.									P.247b							
11.									P.247b							
12.									P.247b							

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
User Control																
13.					P.20											
Multiple Users																
14.									P.247e							
15.									P.247e							
16.									P.247e							
17.									P.247c							
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21.								P.24								
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22.															P.45	
23.															P.45	

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
Command Language																
24.									P.247d							
25.									P.247d							
26.									P.247d							
27.									P.247e							
28.									P.247e							
29.			P.724										P.87			
30.					P.20									P.67		
31.	P.3-1															
32.														P.73		
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34.	P.6-2							P.7				P.5		P.67		
35.														P.54		
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37.														P.53		

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Elke et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
38.					P.20											
39.	P.6-1													P.78		
40.												P.6		P.71		
41.							P.317							P.80		
42.														P.80		
43.													P.5			
44.														P.72		
45.														P.70		
46.	P.6-7															
47.					P.30									P.73		
48.											P.15			P.73		
49.	P.1-5															
50.																Brown et al., 1981 P.6-9
51.																Brown et al., 1981 P.6-9
52.					P.4.2											

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Elke et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
System Response Time																
53.									P.247h							
Form-filling																
54.											P.14					
55.									P.247d							
56.									P.247e							
57.									P.247c							
58.									P.247c							
59.									P.247c							
60.									P.247c							
61.									P.247c							
62.									P.247d							
63.									P.247d							
64.									P.247d							
65.									P.247c							
66.									P.247c							
67.									P.247d							
68									P.247d							

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
69.									P.247d							
70.									P.247d							
Menu Selection																
71.									P.247c							
72.									P.247c							
73.									P.247c							
74.									P.247c							
75.									P.247c							
76.									P.247c							
77.					P.4											
78.									P.247c							
79.									P.247c							
80.					P.4						P.14					
81.					P.10											
82.											P.14					
83.											P.14					
84.									P.247c							

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Elke et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
85.													P.63			
86.													P.64			
87.													P.60			
88.													P.60			
89.												P.16	P.70			

REFERENCE DOCUMENT

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Elke et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
DATA DISPLAY																
Dynamic Displays																
1.									P.245							
2.									P.245							
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4.									P.245							
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9.									P.244							
10.	P.3-1								P.244							
11.									P.244							
12.									P.244							

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CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
13.									P.245							
14.									P.245							
15.									P.245							
16.									P.245							
17.												P.117				
18.										P.43						
19.										P.43						
20.										P.43						
21.									P.244							
22.									P.244							
23.									P.244							
24.									P.244							
25.										P.39						
26.														P.114		
27.																MIL-HDBK-759 (Para. 10.4(e))
28.																MIL-HDBK-759 (Para. 10.5-2)

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Elke et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
29.																MIL-HDBK-759 (Para. 10.5.11)
30.																MIL-HDBK-759 (Para. 10.5.11)
31.									P.244							
32.									P.244							
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43.									P.243							

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
44.									P.243							
45.									P.243							
46.									P.243							
47.	P.2-13															
48.									P.242							
49.									P.242							
50.									P.243							
51.												P.13				
52.														P.56		
53.														P.43		
54.					P.17											
55.					P.10											
Text/Program Editing																
56.									P.247							
57.									P.247							
58.								P.11	P.247							

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
59.									P.247							
60.									P.247							
61.									P.247							
62.									P.247							
63.								P.18								
64.								P.12								
65.	P.4-4															
66.									P.247							
67.						P.32										
68.									P.247							
Display Content																
69.									P.243							
70.									P.244							
71.									P.244							
72.	P.2-10															

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
73.														P.41		
74.									P.244							
75.									P.244							
76.													P.119			
Tabular Data																
77.									P.245							
78.									P.245							
79.									P.245							
80.									P.245							
81.									P.245							
82.									P.245							
83.									P.245							
84.									P.245							
85.									P.246							
86.									P.246							
87.									P.246							
88.													P.126			

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Elke et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
89.														P.49		
90.	P.2-16															
91.									P.246							
92.									P.246							
Textual Data Displays																
93.									P.246							
94.									P.246							
95.									P.247							
96.									P.247							
97.									P.247							
98.					P.7											
Graphic Displays																
99.									P.246							
100.									P.246							
101.									P.246							
102.									P.246							

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
DATA PROTECTION/ ERROR MANAGEMENT																
Verification of Ambiguous or Destruction Actions																
1.									P.247g							
2.									P.247g							
3.									P.247g							
4.																
5.					P.18									P.79		
6.																
7.					P.18									P.69		
System Failures																
8.								P.26								
9.							P.466									
10.							P.466									

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Elke et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
Error Recovery																
11.									P.247h							
12.									P.247h							
13.									P.247g							
14.									P.247g							
15.									P.247g							
16.	P.1-5															
17.	P.1-5															
18.									P.247g							
19.									P.247g							
20.									P.247h							
21.									P.247h							
22.									P.247h							
23.									P.247h							
24.									P.247h							
25.									P.247h							
26.									P.247h							
27.									P.247g							

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Elko et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
28.								P.9								
29.					P.20											
30.									P.247h							
31.									P.247h							
32.	P.1-4			P.23												

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Mill · & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
DATA ENTRY PROCEDURES																
1.																
2.									P.239							
3.									P.239							
4.									P.239							
5.	P.6-2													P.42		
6.																
7.									P.239							
8.									P.239							
9.									P.239							
10.					P.30				P.240							
11.													P.136	P.39		
12.														P.39		
13.									P.247g							
14.											P.14					
15.									P.247c			P.16				

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Elke et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
16.									P.247f							
17.	P.6-2															
18.	P.6-1															
19.									P.247f							
20.									P.247d							
21.														P.45		
22.									P.247a							
23.									P.247d							
24.														P.50		
25.									P.247h							
26.									P.247d							

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Elke et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
FEEDBACK																
General																
1.									P.247e							
2.									P.247f							
3.									P.247f							
4.	P.1-1				P.20											
5.					P.16											
6.			P.722		P.16											
7.	P.2-6															
8.	P.2-6															
9.					P.15									P.80		
10.														P.40		
11.														P.66		
12.														P.72		
13.														P.70		
14.					P.23											

REFERENCE DOCUMENT

CRITERIA	Brown et al., 1980	Cakir et al., 1980	Ehrenreich, 1981	Eike et al., 1980	Engel & Granda, 1975	Grandjean & Vigliani, 1980	Martin, 1973	Miller & Thomas, 1976	MIL-STD-1472C, 1981	Newman & Sproull, 1979	Parrish et al., 1981	Pew & Rollins, 1981	Ramsey & Atwood, 1979	Smith, 1981	Williges & Williges, 1981	Others as noted
Prompts																
15.									P.247f							
16.									P.247f							
17.									P.247f					P.57		
18.	P.1-6										P.56					
19.									P.247f							
20.								P.317								
21.									P.247f							
22.									P.247f							
23.									P.247f							
24.									P.247g							
25.									P.247g							
26.									P.247g							

APPENDIX F

FORMS

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DESIGN CHECKLIST

Test Title ____________________

Test Project No. ____________________ Date ____________________

Detailed Design Considerations	YES	NO	N/A	Comments

YES = Adequate NO = Inadequate N/A = Not Applicable

Detailed Design Considerations	YES	NO	N/A	Comments

TASK CHECKLIST

Test Title ______________________________

Test Project No. ________________ Date ________________

Detailed Design Considerations	YES	NO	N/A	Comments

YES = Adequate NO = Inadequate N/A = Not Applicable

Detailed Design Considerations	YES	NO	N/A	Comments

CHECKLIST IDENTIFICATION AID

Purpose: This form is to be used in conjunction with Table 3 of TOP 1-1-059, Soldier-Computer Interface, during the identification of design checklists and checklist sections.

Directions: For each classification listed in Table 3 that is applicable to the test item, mark off the corresponding checklist numbers and section letters on the list presented below. Once you have marked off a number, it is not necessary to mark it off again. At the conclusion, there should be a comprehensive list of those checklists that are applicable to the test item.

CHECKLIST NUMBERS

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,

18, 19a,b,c,d,e,f,g,h,i, 20a,b,c,d,e,f,g,h, 21, 22, 23

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